

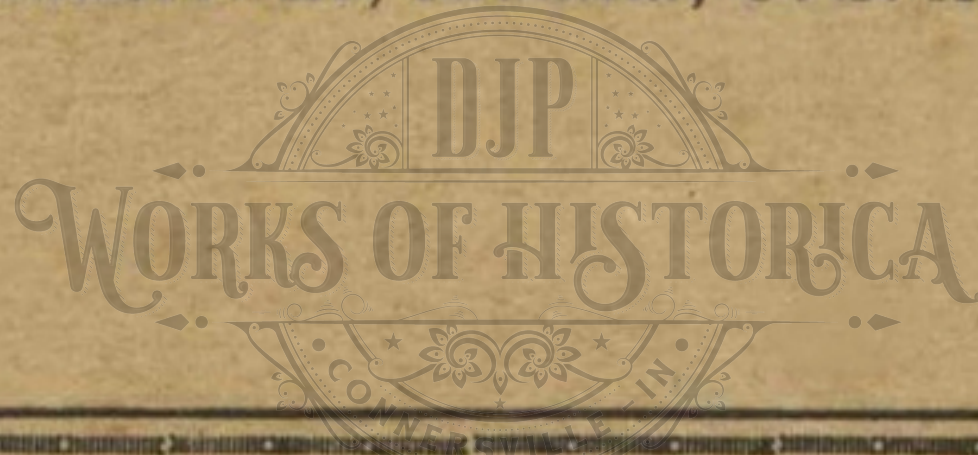
SUGGESTIONS

with Reference to the
Operation and Maintenance
of the

Lexington

Series "R" Models

Lexington Motor Company
Connersville, Indiana, U. S. A.



TO ORIGINAL PURCHASER OF THIS MOTOR VEHICLE:
The Company will forward handsomely engraved Standard
Warranty, executed by the President and the Secretary, upon
receipt of Application attached hereto, provided that said
motor vehicle is subject to conditions thereof.

Application for Standard Warranty

LEXINGTON MOTOR COMPANY

Connersville, Ind., U. S. A.

Date_____

Gentlemen—I am the Owner and Original Purchaser of

(Model)_____, (Serial Number)_____

bought from (Name of Dealer or Dealer Organization)

(Address)_____

(City)_____ (State)_____

on (Date)_____.

This motor vehicle was sold to me as new and un-
used and I will thank you to send me Standard War-
ranty covering same, provided that said motor vehicle
is still subject to terms of said Warranty.

Very truly yours,

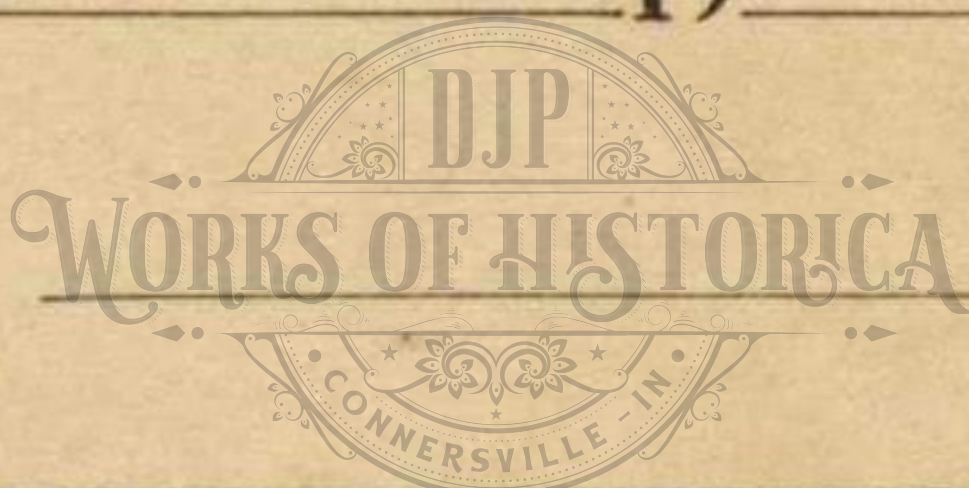
Signature of Owner

Owner's Address

Subscribed and sworn to before me by the said

_____ this _____

day of _____ 19____.



Notary Public

TO HONORABLE THE CHIEF OF THE MOTOR VEHICLE
DIVISION OF THE DEPARTMENT OF COMMERCE
WASHINGTON, D. C.
SIR: I am writing you to advise you that the
motor vehicle is subject to the same laws as
other vehicles.

Application for Standard /

LEXINGTON MOTOR COMPANY
Connersville, Ind. U. S. A.
Date

I am the owner and legal possessor of

(Model Number)

bought from / one of the dealer (Organization)

(Address)

(City)

(State)

This motor vehicle was sold to me as new and un-
used and I will thank you to send me Standard War-
rant Certificate when applied for said motor vehicle
it will subject to terms of said Warranty.

Very truly yours,

(Signature)

(Name)

Subscribed and sworn to before me by the said

(Name)

(Date)

(City)



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Suggestions

With Reference to the Operations and Maintenance of the Lexington Series "R" Models

(1) FOREWARD

The first 200 to 250 miles of driving a new automobile should be done with the greatest care. No matter how carefully an engine has been built and tested, it requires a considerable amount of actual running to get all parts thoroughly worked in. More harm is done to the engine in the first few miles by the average driver than in the following 3,000 miles. The main point to keep in mind is to drive slowly. Never go above twenty-five miles per hour until you have traveled at least 200 miles. Do not try to make the car perform at first. Wait a while and then you can take the hills on high, go forty-five miles per hour, or throttle down to the snail pace without the least bit of harm being done. The engine will remain in adjustment and the original smooth running condition much longer. You will notice the difference at the end of several years.

(2) STUDY THE CONSTRUCTION

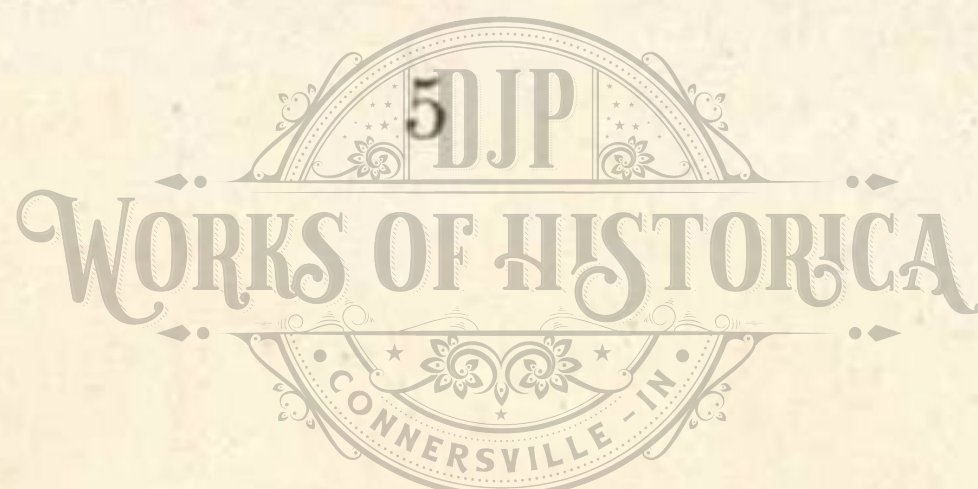
Try to understand every point of your car as soon as you can. Study the car, but above all things do not tinker with the adjustments. Do not turn a single nut until you are certain what it will affect.

The LEXINGTON Minute Man Six engine is of the four-cycle type, which statement means nothing more than that but one explosion takes place in each cylinder for every two complete revolutions of the crank-shaft of the engine. Consequently, with the six-cylinder motor, there are six explosions to every two revolutions.

Gas from the carburetor is drawn into the cylinder through the intake valve or opening as the piston travels down. The piston in an engine would correspond to the plunger in a pump. As soon as the piston reaches the bottom of the cylinder it starts up again and the intake valve closes so that the gas cannot escape. The piston continues to travel up and in doing so forces the gas into a very small space at the top of the cylinder, or, in other words, compresses the gas.

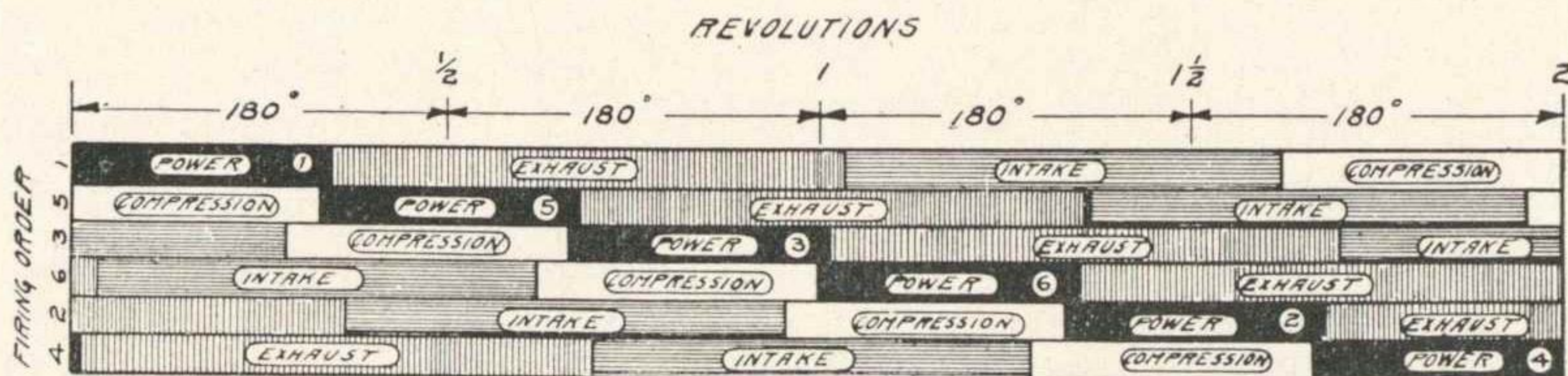
(3) THE POWER STROKE

Just as soon as the piston reaches the top of the cylinder, a little spark jumps across the points of the spark plug and sets the gas on fire and causes an explosion. The gas explodes because it is a mixture of gasoline and air.



This explosion is nothing more than a very quick burning of the gas. It acts just like the powder in a gun when the trigger is pulled and the powder explodes and pushes the bullet out. The same thing happens to the piston. The gas burns or explodes and forces the piston down. Since the piston is connected to the arm of the crankshaft, the crankshaft must turn when the piston pushes down, the same as a bicycle pedal goes down when you push on it, and causes the wheel to turn. This downward stroke of the piston is the power stroke. After the piston travels down and starts up, the exhaust valve opens and allows the burned gases to escape and make room for the fresh gas from the carburetor. The piston travels to the top again and completes the four strokes or cycles. The whole process is then repeated in all six cylinders as the engine continues to run.

Since the gas actually burns in the cylinder, heat is produced. A jacket is cast around the cylinders to hold water. This water is kept circulating through the jacket to the radiator and back by the pump and in this manner keeps the cylinder from becoming too hot.



(4) STROKES SHOWN IN DIAGRAM

There are six horizontal lines shown in the diagram. Each line indicates the different strokes occurring in each cylinder through two complete revolutions. It requires two revolutions to complete the four cycles of the four-cycle engine, as is shown on the first line for cylinder number one. The numbers of the cylinders are indicated on the left-hand side of the diagram. The number of degrees revolution of the crankshaft are plotted horizontally. Along the upper side of the diagram the number of revolutions are indicated by the figures 1 and 2.

The diagram shows how the power strokes of the six-cylinder motor overlap. The power strokes are numbered in firing order. A new power stroke begins at the end of every 120 degrees of revolution of the crankshaft. Beginning with cylinder No. 1, with the piston at the upper end of its travel, the power stroke of No. 1 begins, and when the crankshaft has been turned 120 degrees, power stroke No. 2 begins in cylinder No. 5.

This second power stroke begins before the first power stroke is completed, as may be determined by dropping a straight line down from the end of the power stroke No. 1. It should be remembered that the firing order, that is, the order in which the power strokes occur in the different cylinders, is 1-5-3-6-2-4.

Power stroke No. 3 follows in cylinder No. 3, 120 degrees later. Power stroke No. 4 then comes in cylinder No. 6, followed by power stroke No. 5, in cylinder No. 2, and power stroke No. 6, in cylinder No. 4, at intervals of 120 degrees. Before power stroke No. 6 is completed, power stroke No. 1 begins, and the whole procedure is passed through again. It is the overlapping of these power strokes and the perfect balance of moving parts that gives the great flexibility to the six-cylinder motor.

(5)

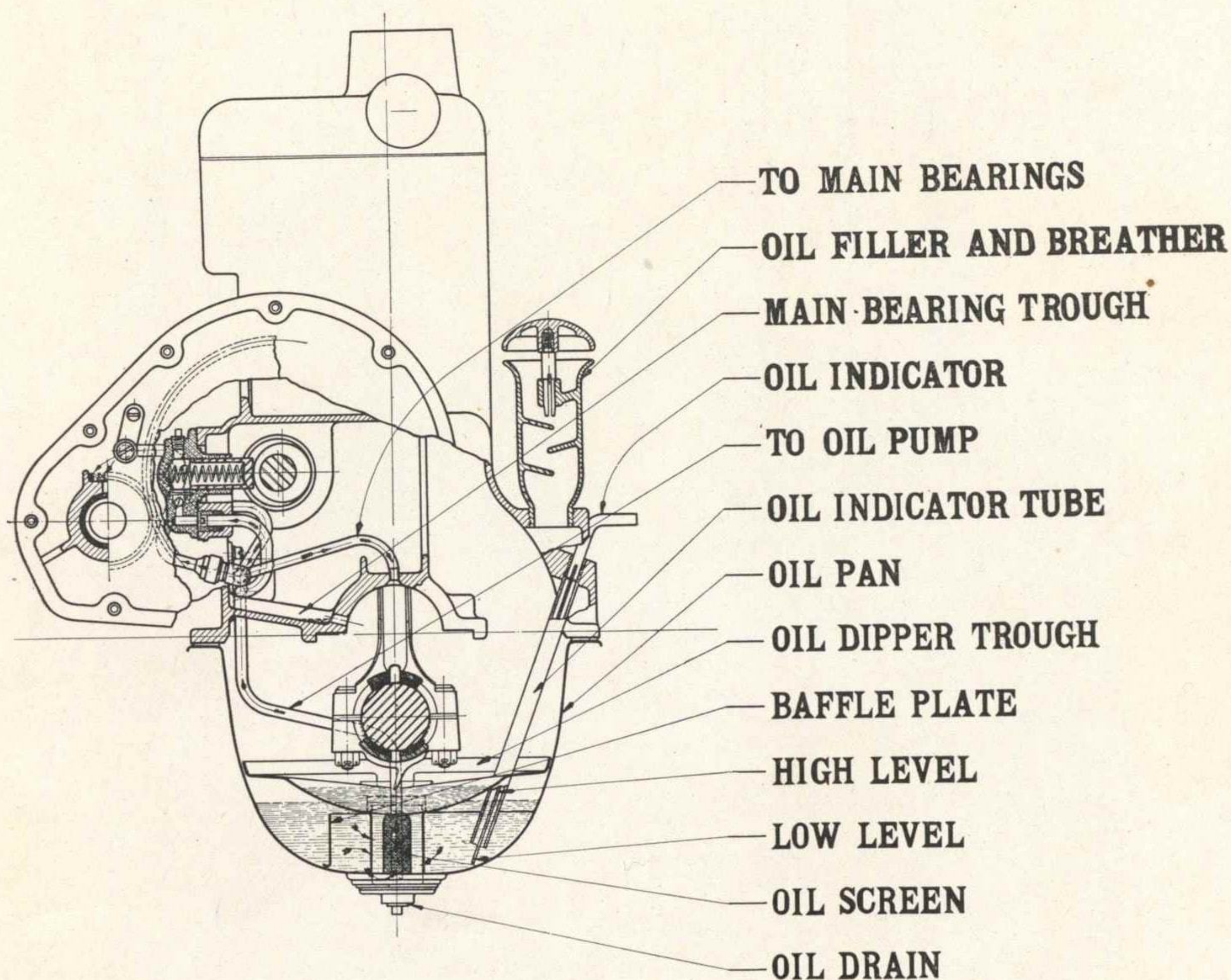
FILLING THE RADIATOR

All water is drained from every car shipped from the factory. Before attempting to start the engine, remove the cap on the radiator by turning it to the left and pour in water until it rises above the bottom of the screen. Use rain water at all times if it can be obtained. Most well water contains minerals that become deposited inside of the radiator and cylinder jacket in the form of scale and sediment, which will cause trouble in time by allowing the engine to overheat. Be sure that the drain cocks at the bottom of the radiator and the water pump are closed.

(6)

PUTTING OIL IN CRANK CASE

Obtain a supply of good oil (Harris medium oil preferred) and pour in through oil filler and breather by unscrewing cap a sufficient amount to bring



oil up to high level indicated on the dial on side of crank case (about 1 $\frac{1}{4}$ gallons). If up to the mark full, this indicates the high level and is sufficient; any more will cause smoking and foul the cylinders and plugs. Add enough oil daily to maintain this level.

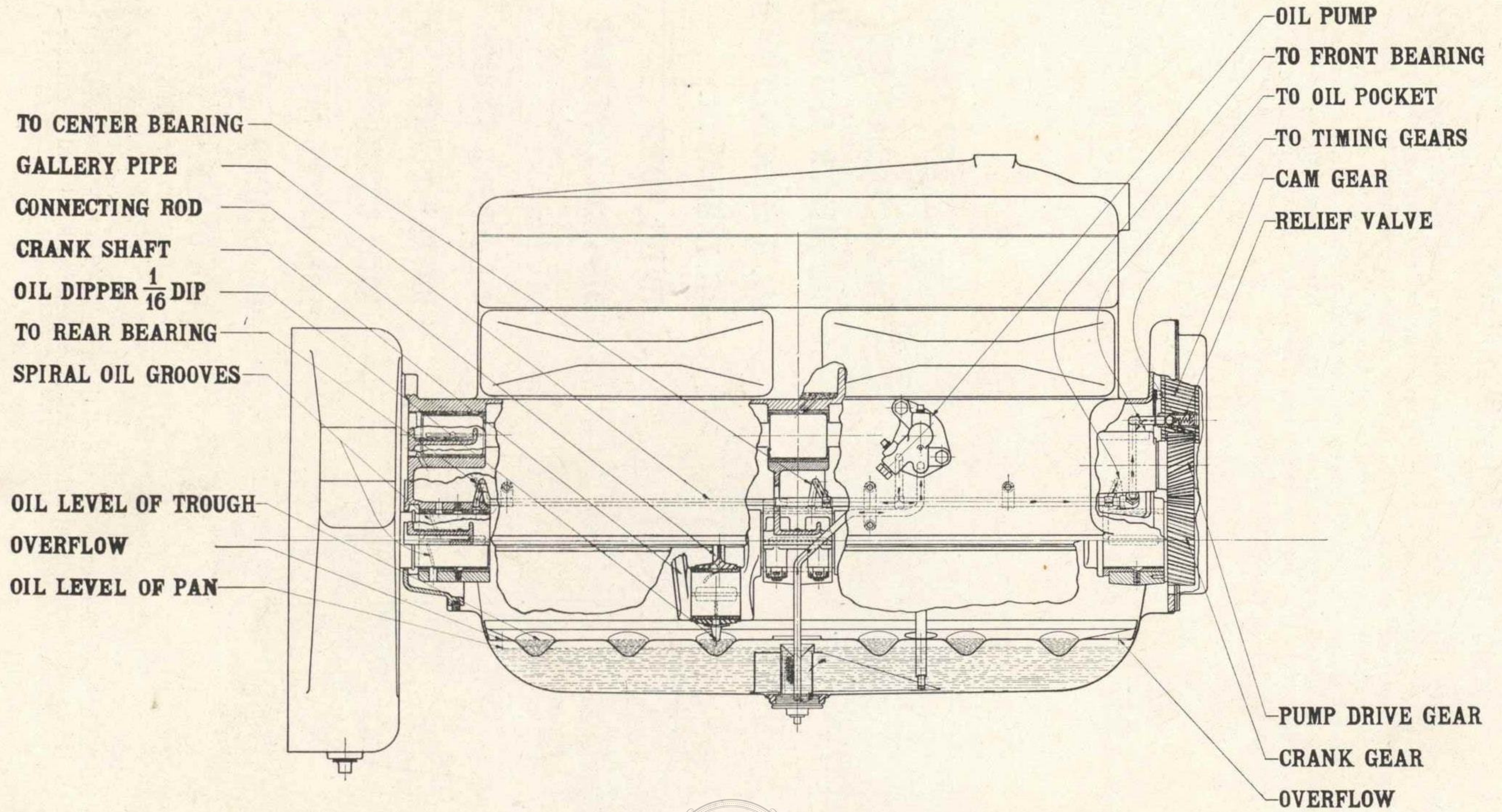


DIAGRAM OF OILING SYSTEM
WORKS OF HISTORICA
CONNEERSVILLE - IN.

(7)

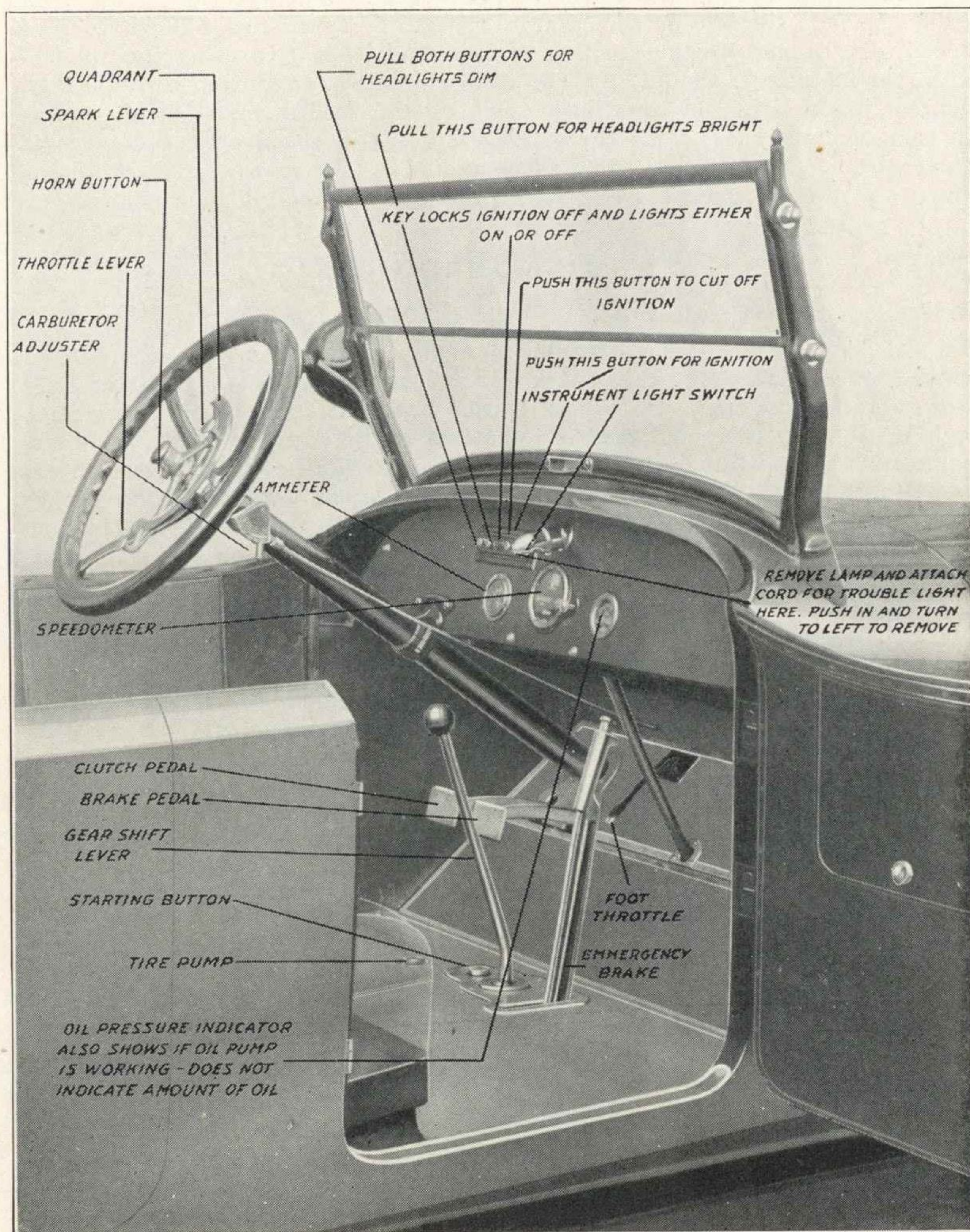
FILLING THE GASOLINE TANK

The main supply tank at the rear of the car has a capacity of eighteen gallons. To fill it, remove the cap and pour the gasoline in through a funnel having a wire screen or chamois skin in it arranged so that the gasoline will be strained. Be very careful that the gasoline is absolutely free from all sediment, water and lint.

(8)

CONTROL LEVERS

On the top of the steering wheel will be found two short levers. The longer one controls the throttle valve in the carburetor that admits the gas



to the cylinders. Pushing up opens the throttle valve and pulling down as far as it will go closes the throttle valve. The other shorter lever controls the timing of the spark so as to make it occur earlier or later in the explosion stroke of each cylinder of the engine. Pushing up advances the spark or makes it occur earlier, and pulling down retards it. The signal horn is operated by the push button in the center of the wheel.

(9) FOOT THROTTLE OR ACCELERATOR

The lever on the floor at the right of the pedal brake controls the carburetor throttle valve as well as the hand lever on the steering wheel by pressure of the right foot. The same control of the speed of the motor is obtained by using either the hand lever or the accelerator. When the foot is removed from the foot throttle or accelerator, the motor speed drops down to that speed, determined by the position of the hand lever. In using the accelerator, the hand lever should be set so as to allow the car to run slowly on high gear or direct drive. Never push down on the accelerator suddenly unless in case of emergency, since the sudden increase in speed produced subjects the entire car to wear that can well be avoided. The man who always has a smoothly running car is the one who is content to handle his car gently.

(10) STARTING THE ENGINE

Be sure that the gear shifting lever is in the neutral position. It is in neutral position when it is standing perpendicular to the floor and can be moved sideways freely. Pull spark and throttle levers down as far as they will go (retard position). Push the ignition button in (the one on the extreme right). Pull up the small lever on the carburetor adjuster as far as it will come towards gas (marked G). Step on the starting button (the one on extreme left side). *As soon as engine starts, open throttle lever* about two inches immediately. This is necessary to keep from flooding engine with gasoline, as with throttle closed and carburetor adjusting lever pulled up as far as it will go, *opens a by-pass around throttle valve in carburetor, giving a priming charge*, which is extremely rich for starting a cold engine, as in winter starting. Never hold foot on starting button after engine is running, as this is unnecessarily wasting current from battery. Advance spark lever about one-third way up on quadrant. Carburetor adjusting lever can now be pushed down slightly, feeling, as it were, for a point where engine runs best (hitting evenly). As soon as engine warms up sufficiently for warm air to begin passing through carburetor this lever can be pushed down as far as it will go (marked A) and should be used in this position while operating car with engine warm, as in this position it is most economical. With a warm motor, as in warm weather, it will not be necessary to use carburetor adjust in starting; simply open throttle about an inch or so. (You do not need to prime a warm engine.)

(11) TO STOP ENGINE

To stop the engine, push the second button from the extreme right.

It is good practice to push the throttle lever about one-half way up the quadrant while the engine is still running, after the switch has been turned off. This allows the cylinders to become filled with fresh gas, which will make the starting of the engine easy the following time. Be certain that the switch is always off when engine is not running. In order to guard against any trouble, such as running battery down should the switch be left on at any time, we have provided an "automatic kick off" on inside of switch housing, oper-

ated electrically, to break the connection in about thirty to forty-five seconds. Switches should be locked when car is to be left standing unattended to prevent unauthorized persons from operating same.

(12)

CONTROL SYSTEM

Practice should be taken in starting and stopping the car. Pressing down on the clutch pedal. Left one releases the clutch—that is, disengages the clutch. It should always be allowed to return to its normal position very gradually. The right pedal operates the service brakes. The center lever extending through the floor nearest the steering wheel is the gear shift lever. The other lever operates the emergency brakes. When the gear shift lever is in its center position, perpendicular to the floor, it is in the neutral position—that is, no gears of the transmission are in mesh, and the car will not move, even though the engine, is running and the clutch is engaged.

It is often helpful to shut off the engine entirely, and then go through the steps of shifting the gears. Pulling the gear shift lever to the left and back gives the correct position for first or low speed. Shifting the lever back to the neutral position and then to the right and forward gives the second or intermediate speed. Pulling the lever back to the right gives the third or high speed. The reverse speed is obtained by shifting the lever from neutral position to the left and forward. In going from first to second speeds, or to the reverse, it is always necessary that the lever be shifted to the neutral position first and then to the desired position. Try shifting the lever to each position several times to become acquainted with the different positions. Always bring the lever to neutral position so that no gears will be in mesh when the motor is started again.

(13)

DRIVING THE CAR

To start the car after the engine is running slowly, push the clutch pedal down as far as possible and hold it there. Pull the gear shift lever to the left and back into first speed, where it will seem to lock when back far enough. Then as the clutch pedal is gradually allowed to come back to normal position—that is, when the clutch is allowed to engage—the engine may be speeded up a little by pushing up on the throttle. The car will now move along slowly. The first speed is used only to get the car rolling. To get into second speed, slow the engine down as the clutch pedal is being depressed—not before. Hold the clutch pedal down and quickly push the gear shift lever back to neutral position and then to the right, forward position of second speed. The clutch pedal may now be allowed to return gradually, and the engine should be accelerated as the clutch engages. As soon as the car is moving along well in second speed, the shift to third should be made in the same manner. The car should be run on third or high speed as much as possible. Never try to shift into reverse until car has been brought to a complete standstill. Any speed from one to forty-five miles per hour may be attained with the gears in this position on the level stretches by shifting the spark and throttle levers.

Care should always be taken that the engine is slowed or throttled before shifting the gears in going from a low to a high speed, and then accelerated as the clutch engages. In climbing hills, it is sometimes necessary for the beginner to drop back from third to second or even first speed. In this case the engine should be speeded up—not throttled—when the clutch is released, before the gears are shifted. It is necessary to handle the engine in this manner, so that the gears in the transmission will be turning at the proper speed before any attempt is made to shift them into mesh. A little practice will enable the gears to be shifted without grinding and clashing. The clutch should not be allowed to engage until it is certain that the shifting lever is in its

extreme limit for each position, which may be determined by the tendency of the lever to resist pulling it out of each position. In other words, it seems to catch slightly when in the proper position. Drive slowly and cautiously when learning and always get the car well under way before changing to a higher gear.

To stop the car close the throttle and then depress the clutch pedal and gently apply the brakes by either the foot pedal or the emergency brake lever. In case an emergency demands a sudden stop, depress both the clutch and brake pedals and pull back the emergency brake lever. When the car comes to a stop, do not remove the foot from the clutch pedal until the gear shift lever has been shifted to neutral. Always set the emergency brake when the car is allowed to stand.

Descending long, steep hills on the brakes alone, tends to wear and burn them out. Learn to use your engine as a brake. On ordinary grades push the throttle lever back to full retard position and leave the clutch engaged so as to allow the car to drive the engine. On exceptionally steep or rough hills, shift into second or first and again allow the car to drive the engine. If the car still descends too rapidly, use the brakes.

(14) **USE THE SPARK LEVER**

The position of the spark lever should vary with the speed of the motor. For persons who are operating their first car, it simplifies the driving if the spark lever can be left in one position. About the best rule that can be given is to imagine the quadrant divided in proportion to the car speed, assuming that the spark should be fully advanced for the maximum speeds.

In following out this idea, the spark lever should be advanced to a position one-quarter of the way up the quadrant for speeds of ten to fifteen miles per hour; a position approximately in the center of the quadrant for speeds of twenty to thirty miles; a position of three-fourths the quadrant for thirty-five to forty miles, and full advance for all higher speeds. If it is desired to leave the spark lever in a fixed position, the position for average conditions of between one-fourth and one-half way up the quadrant will give fair performance, but the power and general economy will be effected in the extremes of speed variation. The spark should be fully retarded when the car is to be throttled to its lowest speed on high gear.

The general principle to follow is to keep the spark advanced as fully as possible. If advanced too far a sharp, metallic click will be heard in the engine and the spark should be retarded or the bearings will be damaged by having the spark occur too early. A fully retarded spark will cause excessive heat and loss of power, since the spark occurs after the piston has started down on the explosion stroke. Neither extreme should be adhered to, and a little study will soon show the best position for the spark lever under the varying conditions.

When the engine is running idle the spark lever should not be advanced to a position more than a fourth of the way up the quadrant.

(15) **CLUTCH**

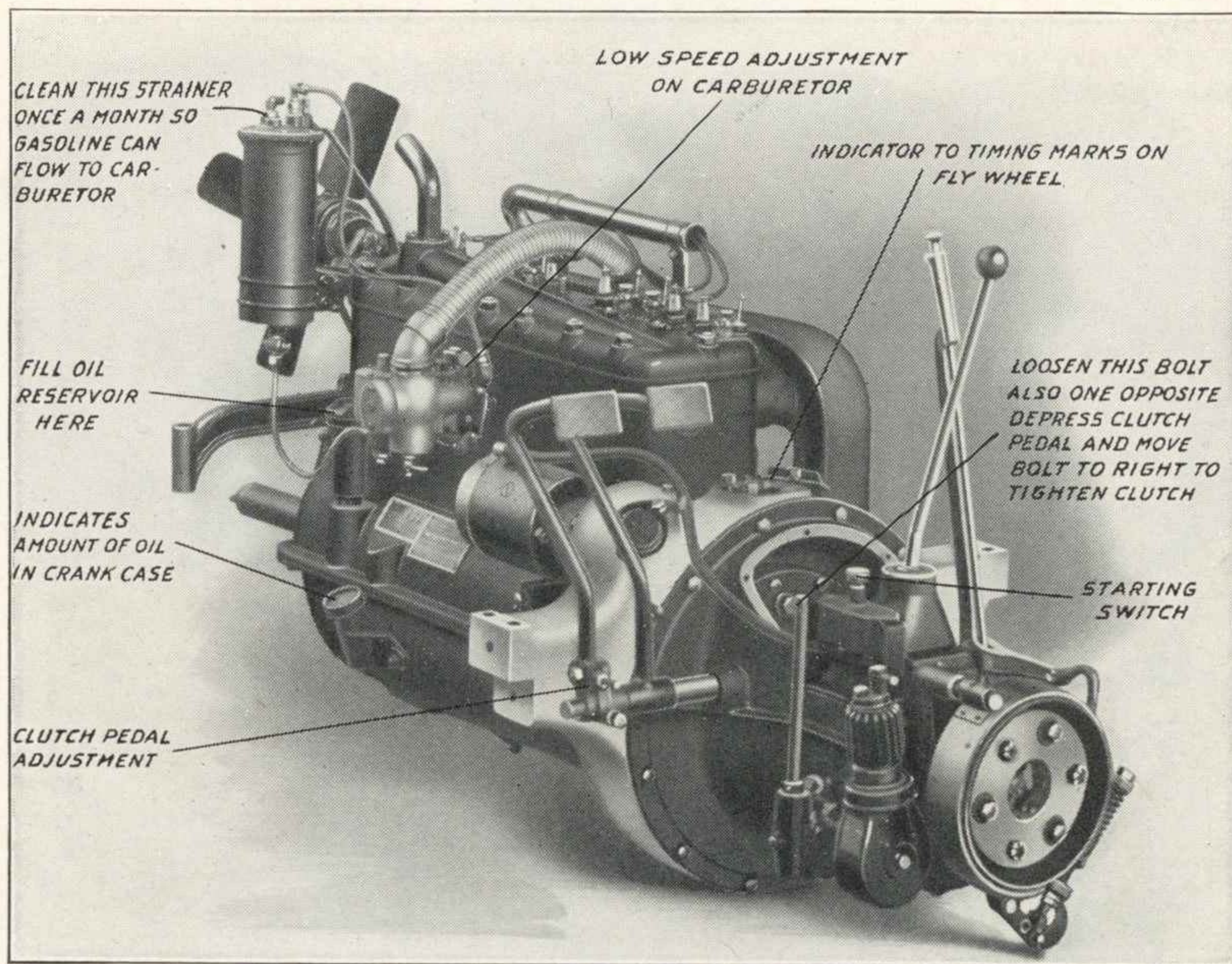
The clutch is nothing more than a means of breaking the connection between the engine and the rear wheels. It consists of a series of plates that are held firmly together by means of coil springs. The driven plates, or friction discs, are mounted on the shaft that extends through the transmission and must turn with this shaft. The driving plates are attached to the fly wheel and turn with it. Consequently the shaft which extends back to the transmission must also turn when this pressure is applied. This pressure is removed when the clutch pedal is pushed down. This action causes the coil springs to be pushed back so that the friction discs are no longer held between the plates and fly wheel. The engine may then run without turning the transmission shaft.

No oil or grease should be put on the friction surfaces at any time. Grease will cause the clutch to slip. Should any grease reach these surfaces through any cause it may be washed out by squirting kerosene into the clutch through the opening in the cover-plate around the transmission drive shaft.

(16)

CLUTCH ADJUSTMENT

Remove cover plate on clutch housing. Turn engine over slowly until one of the large bolts on clutch case comes up into view; loosen this bolt until it is free. Turn engine half over (one-half revolution), exposing a second bolt.



After loosening this, press clutch pedal down as far as it will go with the left hand and with the right hand move the bolt to the right in the slot, clockwise, about one-half inch, or more if necessary, being careful not to set up too tight or clutch will not release, which will prevent shifting gears.

Be sure to tighten both bolts securely, moving the bolt to the left loosens the clutch, moving same to the right tightens it.

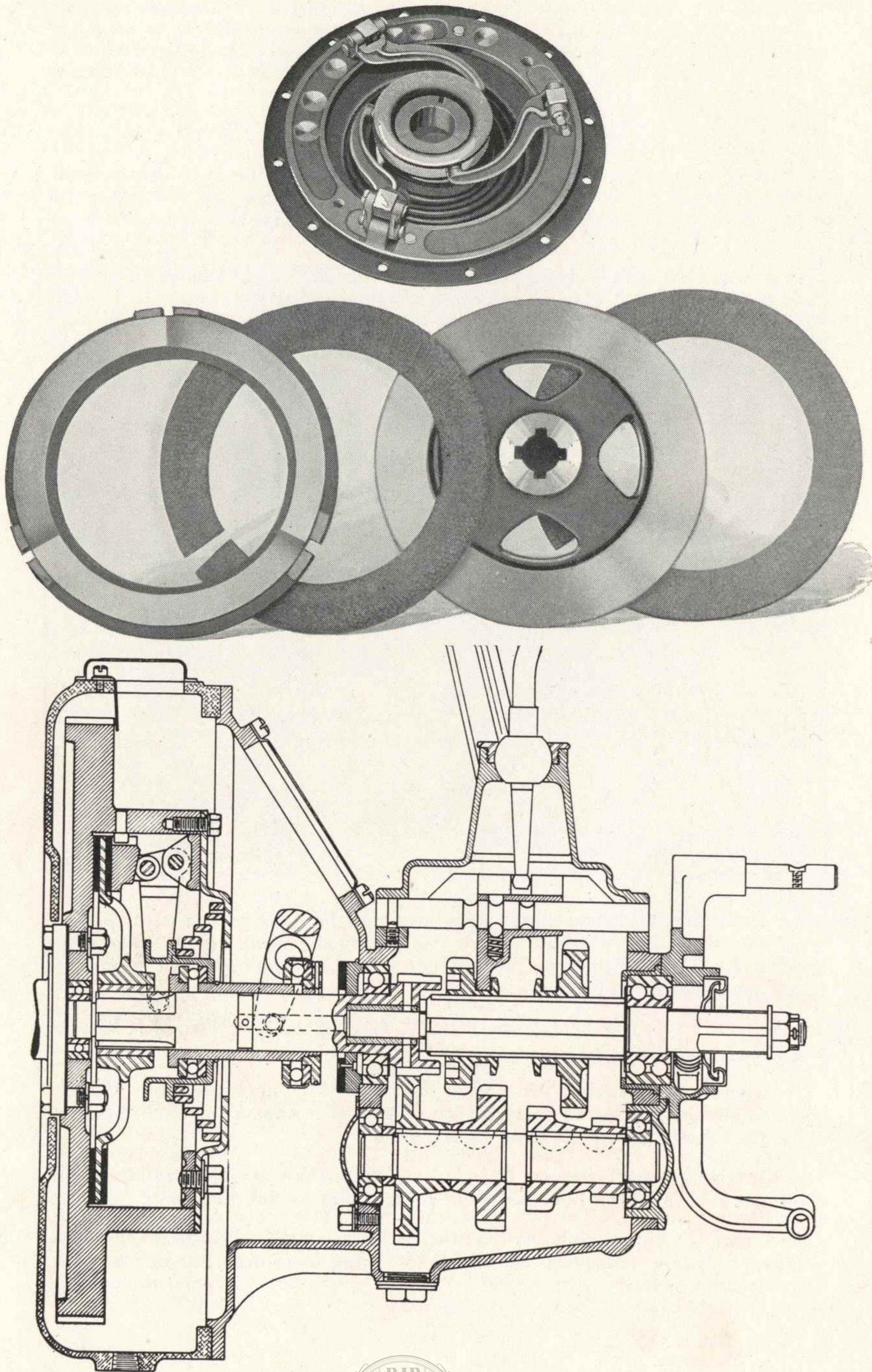
If bolts adjust against last end of the cover slot, screw them out of their mounting holes and set them back into repeat holes exposed near first end of slots, thus doubling the range of adjustment.

Clutch throwout bearing is oiled automatically by the transmission; the shaft is drilled and provided with radial holes for lubrication of bearing.

Adjust the clutch pedal so that the pad projects 6 inches from toe board measured on line with pedal shank, by loosening the clamp nut and moving stop screw in or out.

(17)

TRANSMISSION



Any automobile engine will develop the most power at the least cost between certain speed limits. Ordinary driving of a car will require a great variation in the car speed. In order to keep the engine speed at a comparatively constant speed, a system of gears are used in transmission so that, though the rear wheels turn very slowly or very fast, certain gears may be slipped into mesh by the gear shift lever that will keep the engine running at about the same speed.

The transmission consists of two shafts on which are mounted spur gears. The shaft extending back from the clutch reaches just inside of the transmission and has a gear mounted on the end. As long as the shifting lever is in neutral position this gear is free to turn without turning the main shaft, and consequently the engine may run with the clutch engaged without driving the car. The gears on the lower shaft are rigidly attached, while the gears on the upper shaft are free to slide along the shaft. The gears are of different sizes, and by sliding the free gears into mesh with the fixed gears, different speeds are attained and transmitted to the propeller shaft, which extends back to the rear axle. The gear shift lever at the right of the driver is used to shift these gears.

(18)

UNIVERSAL JOINTS

The universal joints are made up of layers of Sea Island cotton fabric, placed spirally to each other; impregnated with rubber and vulcanized into discs $\frac{5}{16}$ " thick.

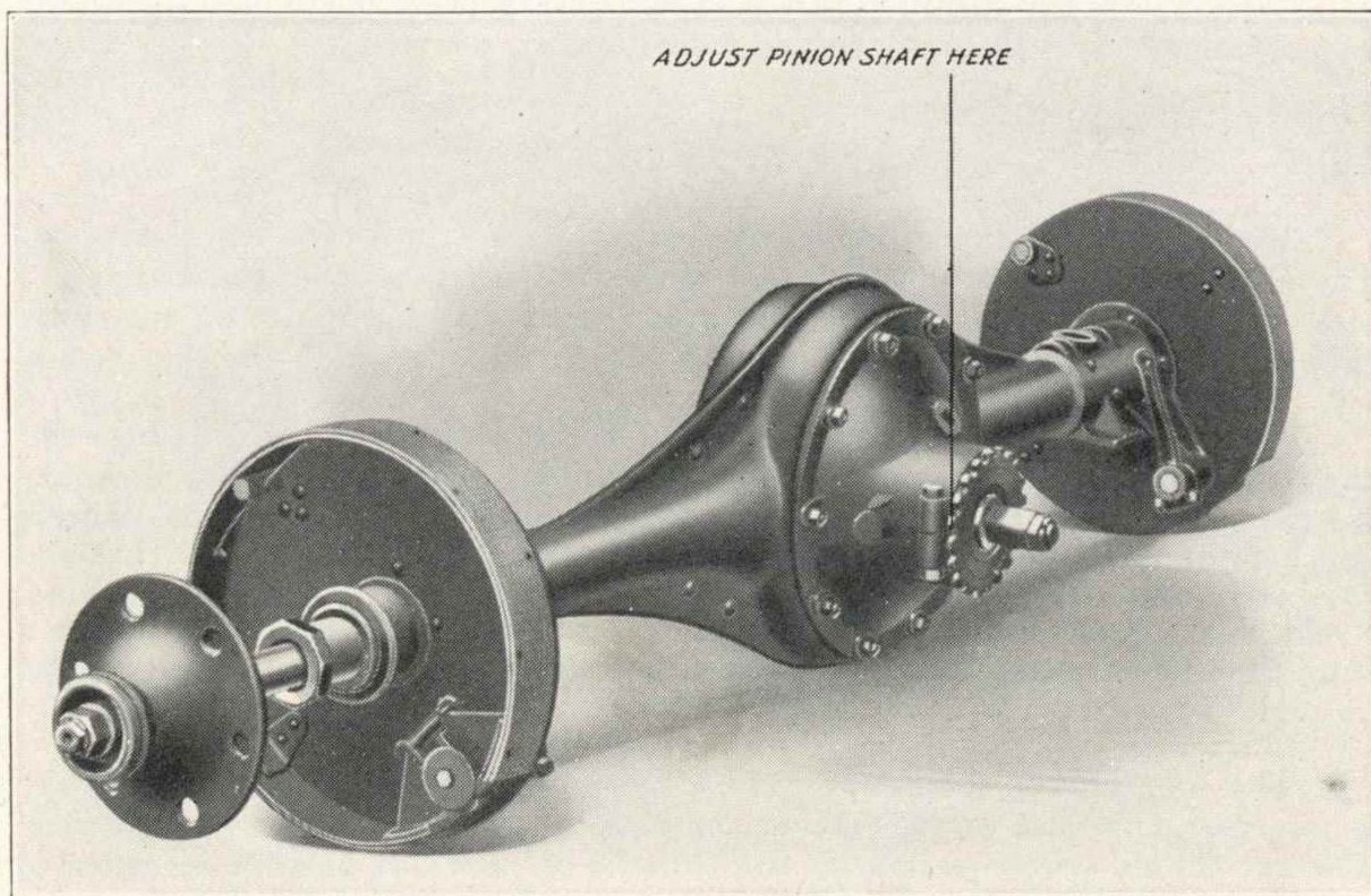
Three of these discs are mounted, with spacing washers and bolts to three arm spiders at both transmission and axle ends of shaft, forming a flexible connection between transmission and rear axle, without any lost motion.

There are no metallic connections to rattle, nothing to oil and require no attention.

(19)

REAR AXLE

The rear axle is of the full floating type, which means that the shafts which turn the wheels float in the axle housing without supporting any of the weight of the car. The wheel bearings are mounted directly on the axle housing.



(20)

REAR WHEEL BEARINGS

The bearings in the rear wheel hubs are known as the "Bower Roller No. 210-AXL." Two individual bearings are placed in each hub to make one complete bearing. Not only will the complete bearing carry the direct load, but it will withstand side thrusts in all directions.

The outer races are pressed into the wheel hub. A collar on inside carries a felt washer that prevents the grease from working into the brake drums. In placing the wheel on the axle housing, first push on one of the roller bearings, having the shoulder, which is the part that takes the thrust, on the roller turned towards the inside, that is, the center of axle, and push up tight against shoulder on axle housing. Next put on wheel, pushing it on as far as it will go, then put on the outer roller bearing, turning the shoulder on the roller, this time towards the outside.

Put on one of the large nuts and screw up tight to seat the bearing, then back off about one-quarter turn so as not to have the bearing too tight. Slip on the lock washer. Put on the jam nut and screw up tight. To lock the whole assembly, bend one of the lips on the washer over one of the flats on the locking nut to prevent same from working loose.

Put in the floating drive shaft with flange attached, slipping the squared end into the differential hub. (It may be necessary to rotate shaft slightly to get the square end of shaft to match up with square hole in differential hub.) The holes in flange will slip onto the studs in wheel hub, put on lock washers and screw up nuts tight.

(21)

TO REMOVE REAR WHEELS

Remove the six nuts around the hub flange on each wheel and pull the flange and the attached drive shaft out. Pry up the lip of the lock washer that holds the lock nut, unscrew the lock nut, pull off the lock washer and remove the adjusting nut. The wheel can now be pulled off, together with the outer bearing. If any difficulty is encountered in getting the flange off, drive a small metal wedge behind the flange in the slots provided.

(22)

BRAKES

The foot brake shoes press outwardly against the drum when applied. There is no adjustment to make inside of the drums. Whenever the wheels are removed it would be advisable to put a little grease and graphite on the cams that spread the shoe out, and on the pivot pins about which the shoe turns.

The brakes can be adjusted by changing the lengths of the rods between the rear axle and the brake cross shaft, also under front floor boards. In making the adjustment see that the brakes are adjusted evenly so that both wheels will lock at the same time when the brakes are applied. Be careful that the rods are not shortened too much or the brakes will rub against the drums. Brake lining is used on the shoe inside of the drum and needs to be replaced from time to time, depending upon how the car is handled. The wheels should be removed once or twice every season for inspection of the lining.

The foot brakes should be used for ordinary service. The hand brake is for emergency use or for setting the brakes when the car is left standing. The car should be controlled by the throttle as much as possible in order to prevent excessive wear of the brake lining.

(23)

FRONT AXLE

It is very important that the nuts on the spring clips which hold the springs on the axle be kept drawn up tightly. If the clips are allowed to remain loose, there is danger of breaking the lower spring leaves.

To remove a front wheel, first remove hub cap, pull out the cotter pin, (through the nut on the spindle,) unscrew the nut, and pull the wheel off.

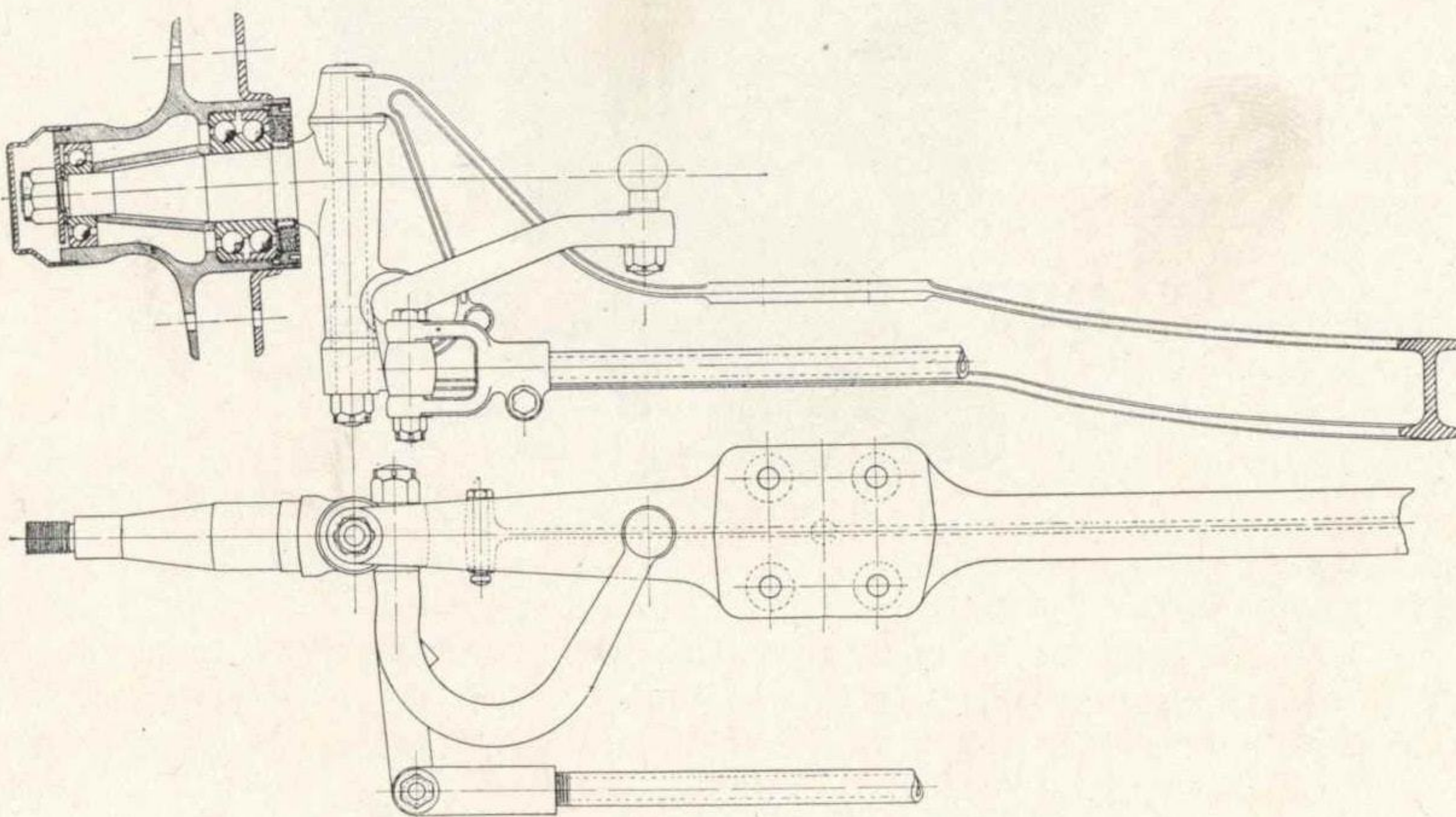
To replace wheel, push wheel on spindle against shoulder, put on the spacing sleeve or collar, put on the small annular ball bearing, push it against the sleeve, put on small washer, then the larger washer, and screw up the nut tight. **The bearings are non-adjustable and need no adjusting.** Put in cotter pin to lock the nut, then the hub cap.

(24)

STEERING GEAR

The steering mechanism should receive a regular inspection and should be kept well lubricated. A single adjustment is provided to take up any play that might develop. When the adjustment is properly made the steering wheel may be turned an inch or so without affecting the wheels. This small amount of play is desirable, inasmuch as such lost motion makes driving much less tiring to the wrists and forearms.

To take up the play in the steering gear, raise the hood on the left side. At the top of the steering gear housing will be found a collar that has notches cut in it. Loosen the bolt just under the collar and turn the collar in a clockwise direction. Be careful not to draw it up too tightly, for there is danger of damaging the bearings. Try the adjustment in several positions. There is also an adjustment in each end of the drag link which connects the left steering knuckle arm with the steering gear crank arm. These adjustments can be taken up by removing the cotter pins and turning up the nuts on the ends of the link. Turning up these nuts, forces the springs against the cups that fit against the ball ends of the knuckle arm and steering gear crank. Do not turn the plug up too far. The adjustment is sufficient when no rattle or lost motion can be detected by attempting to move the drag link backward and forward by hand.



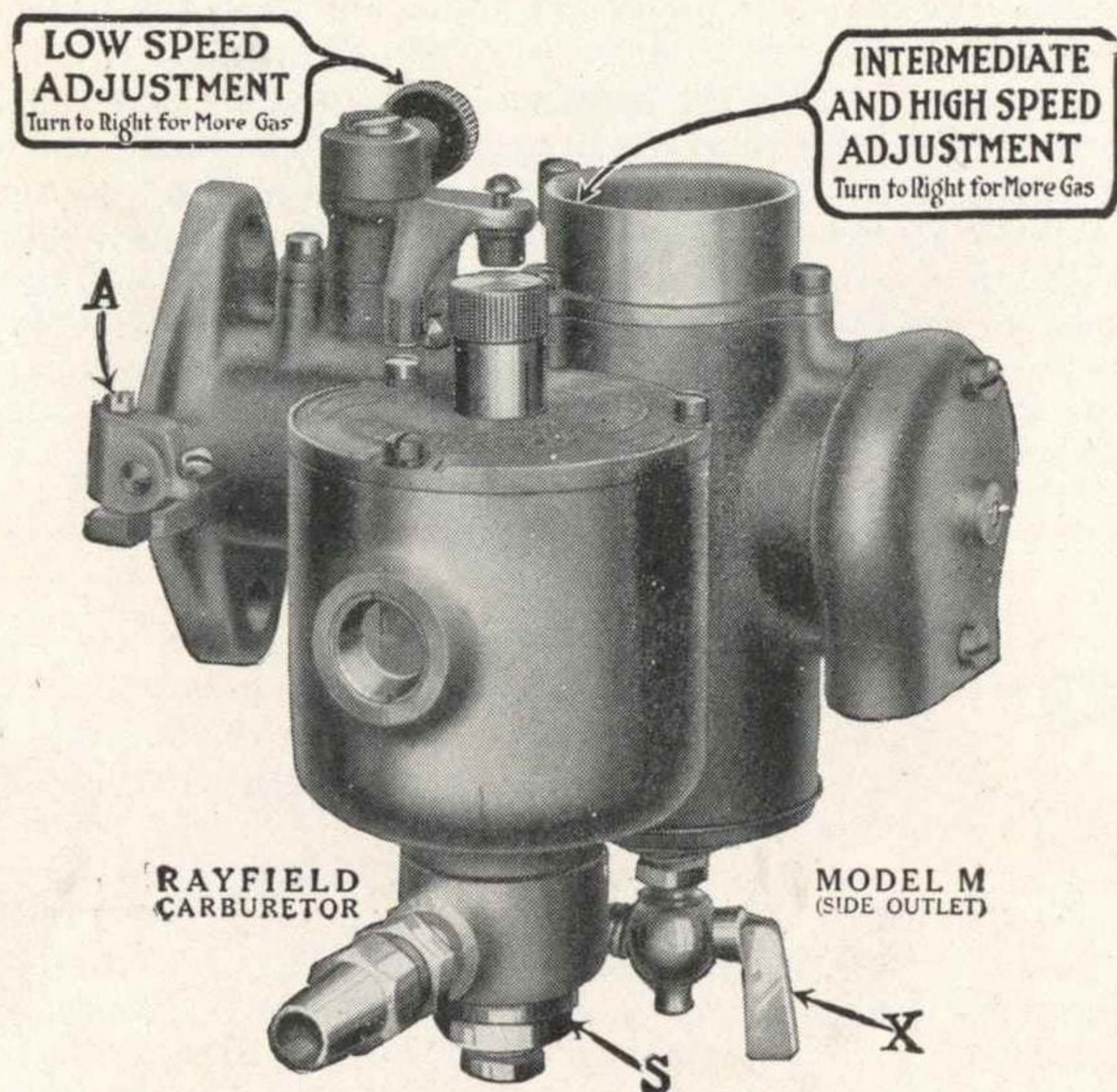
CARBURETOR

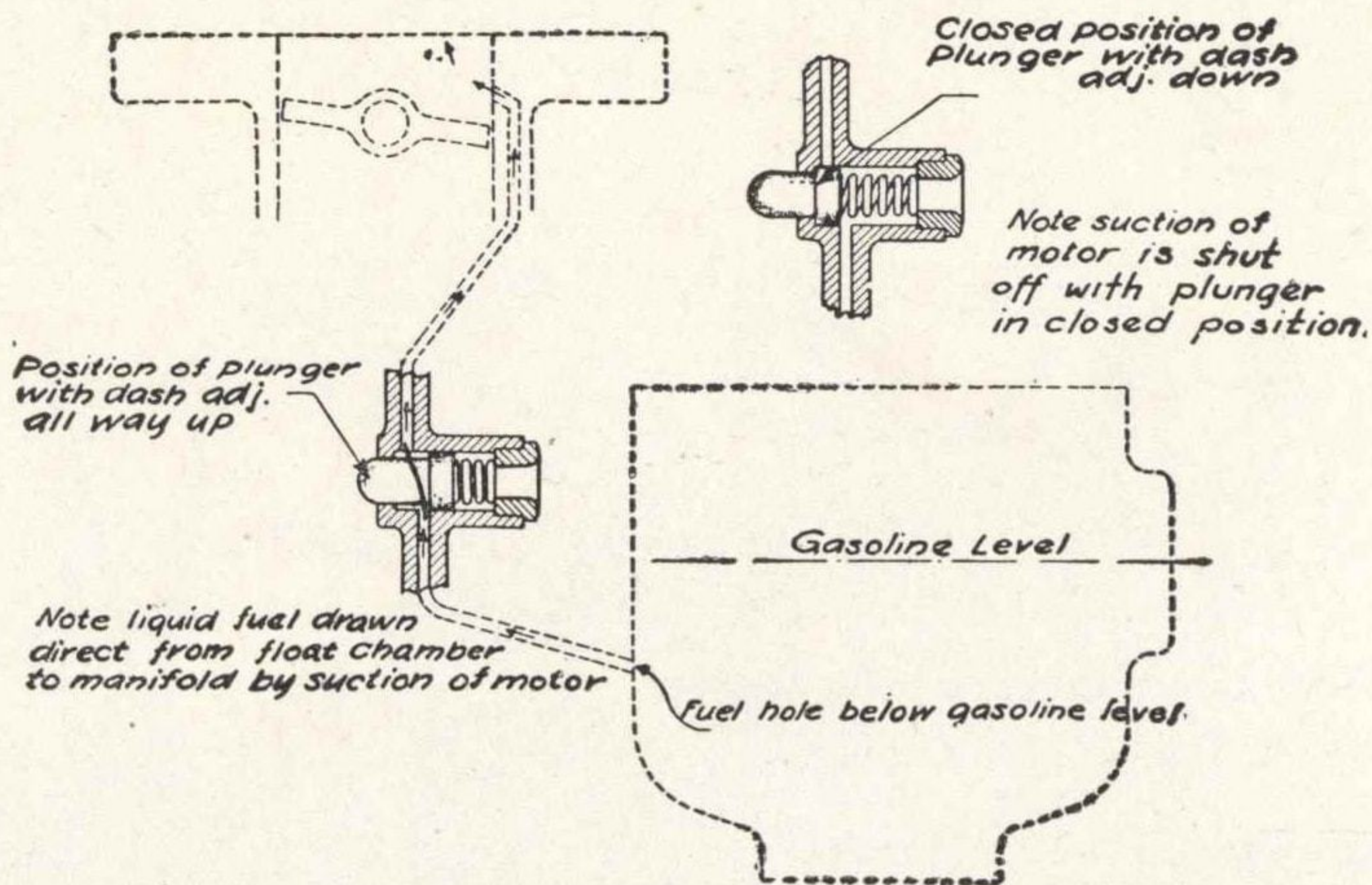
Caution.—Before adjusting the carburetor, be sure there are no obstructions in the gasoline line; that connections are absolutely tight and free from air leaks; that valves and ignition are properly timed, and that there is a hot spark and good compression in all cylinders.

Adjusting.—The Model M RAYFIELD CARBURETOR has two adjustments, one for low speed and one for intermediate and high speed. These adjustments cannot change after being set as they are positively locked.

THE LOW SPEED ADJUSTMENT should be turned to the right or left as required until motor runs properly at low speed. If motor does not throttle low enough, turn stop arm Screw "A" (see cut) to the left until it runs at the lowest number of revolutions desired.

THE HIGH AND INTERMEDIATE SPEED ADJUSTMENT is made accessible by removing the hot air elbow from over the main air valve. Do not move the high speed screw more than one-eighth turn at a time. Turn it to the right for richer and to the left for leaner mixture. This setting, being very effective, will greatly determine the fuel economy; therefore, make sure it is set as lean as possible, still retaining good acceleration.





(26)

CARBURETOR ADJUSTMENT

The above cut shows the principle of the very effective primer incorporated in the Model M RAYFIELD Carburetor (side outlet type).

First: CLOSE the throttle and pull dash adjustment all the way up.

Second: When motor starts, open throttle slightly and push dash adjustment one-quarter of the way down.

Third: As motor warms up, push adjustment down gradually as required. When thoroughly warm, push adjustment all the way down.

Explanation.—Raising the dash adjustment lifts the spray needle and supplies a richer mixture. When it is raised full distance, a direct passage is opened permitting raw gasoline to be drawn from fuel chamber of the carburetor to motor. (See sketch.)

Note.—We urge the use of radiator covers or other means of keeping the motor temperature up in cold weather. Good results cannot be expected with a cool motor.

Caution.—See that throttle is CLOSED for starting. Make sure the dash adjustment is connected correctly so that priming plunger is all the way in when dash adjustment is completely up.

Fuel conditions at present require the application of an abundance of heat to the carburetor.

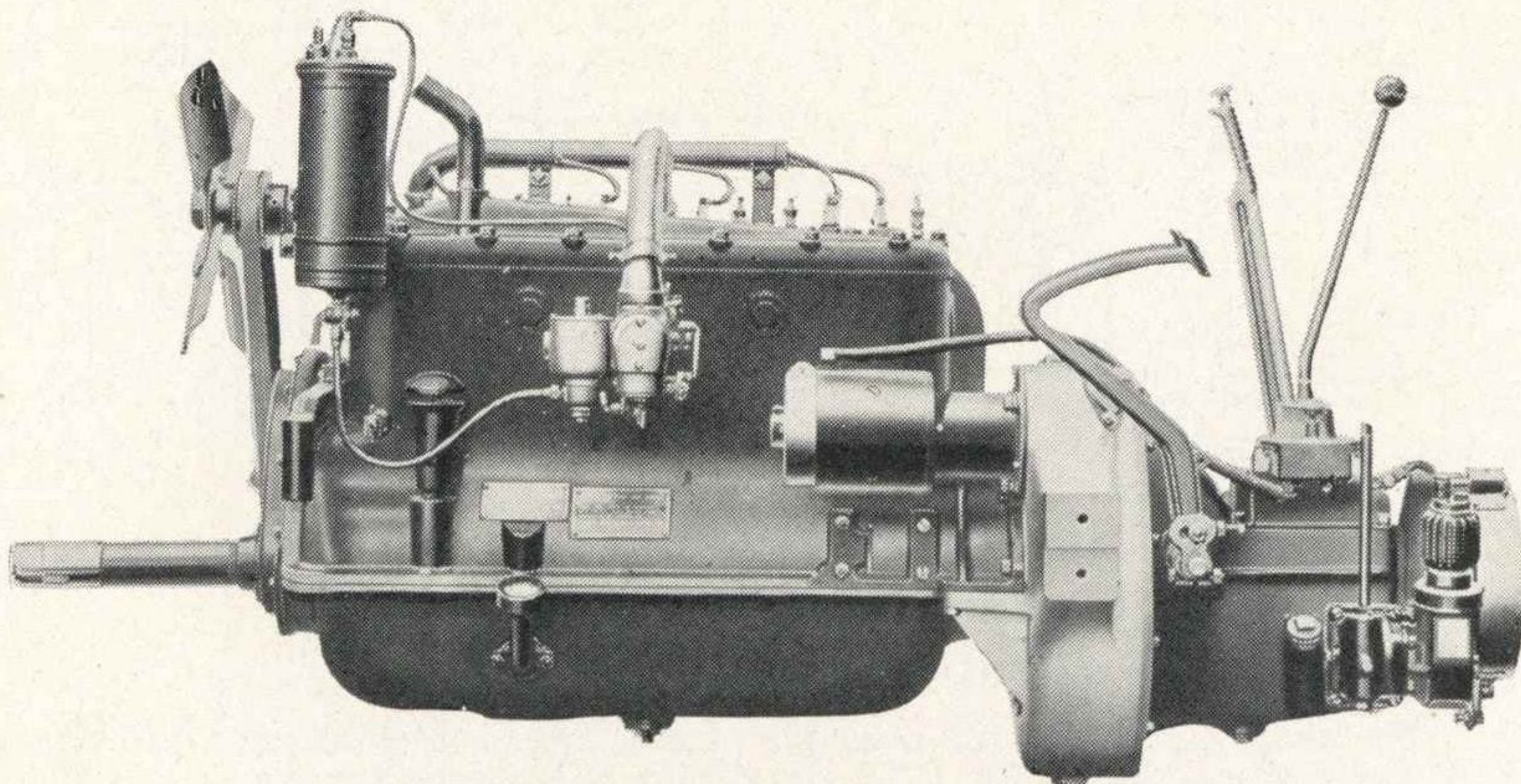
Do not under any circumstances attempt to operate the Model M RAYFIELD without the use of hot air.

The float level is correctly set at factory. DO NOT CHANGE IT. If for any reason carburetor does not give desired results, get in touch with a RAYFIELD Service Station or write the factory.

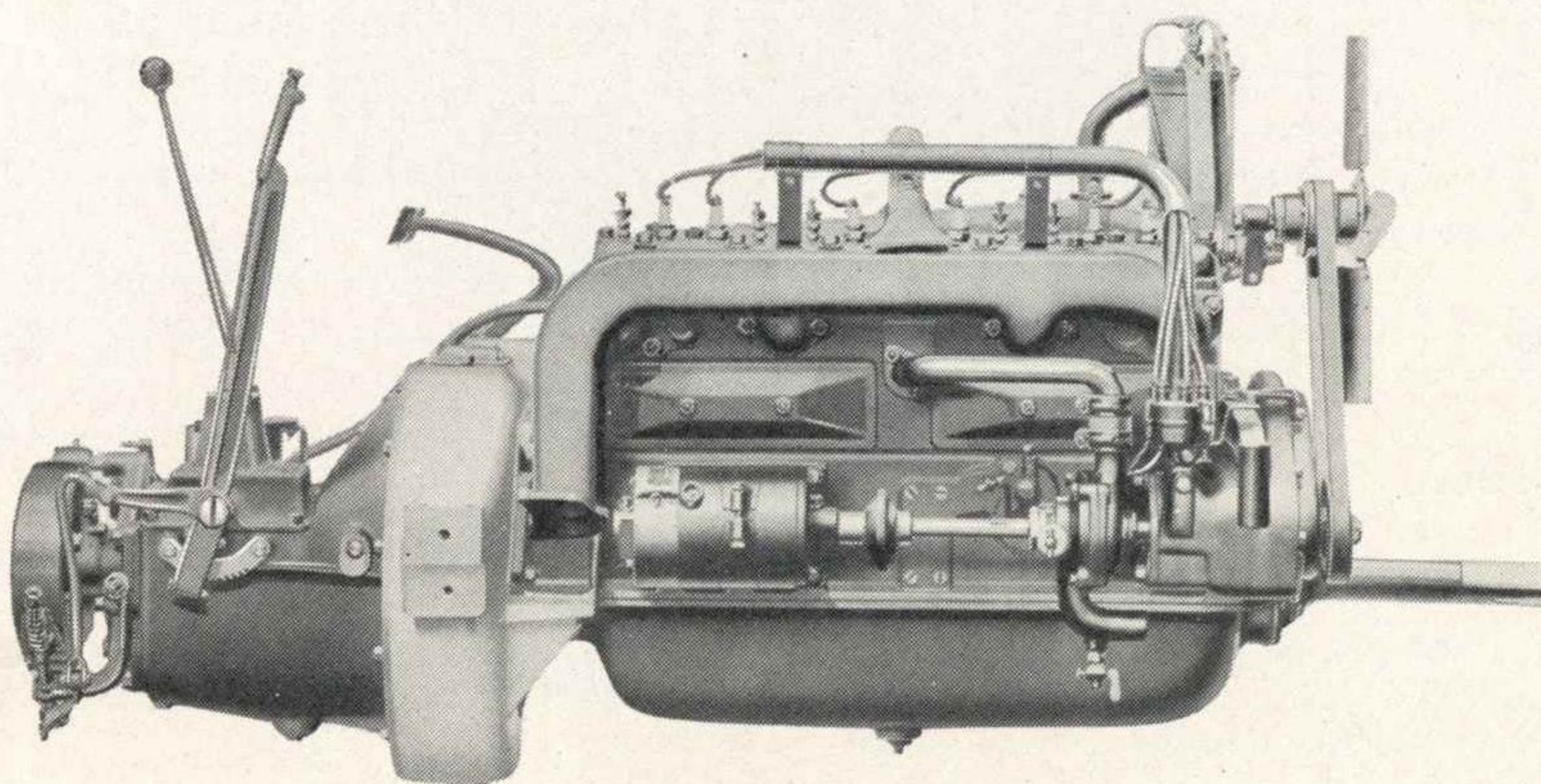
The float chamber and dash pot should be drained occasionally through drain cock "X" and plug in nut "S" to remove water and sediment which may have accumulated.

All RAYFIELD Carburetors are equipped with a strainer trap at bottom of float chamber.

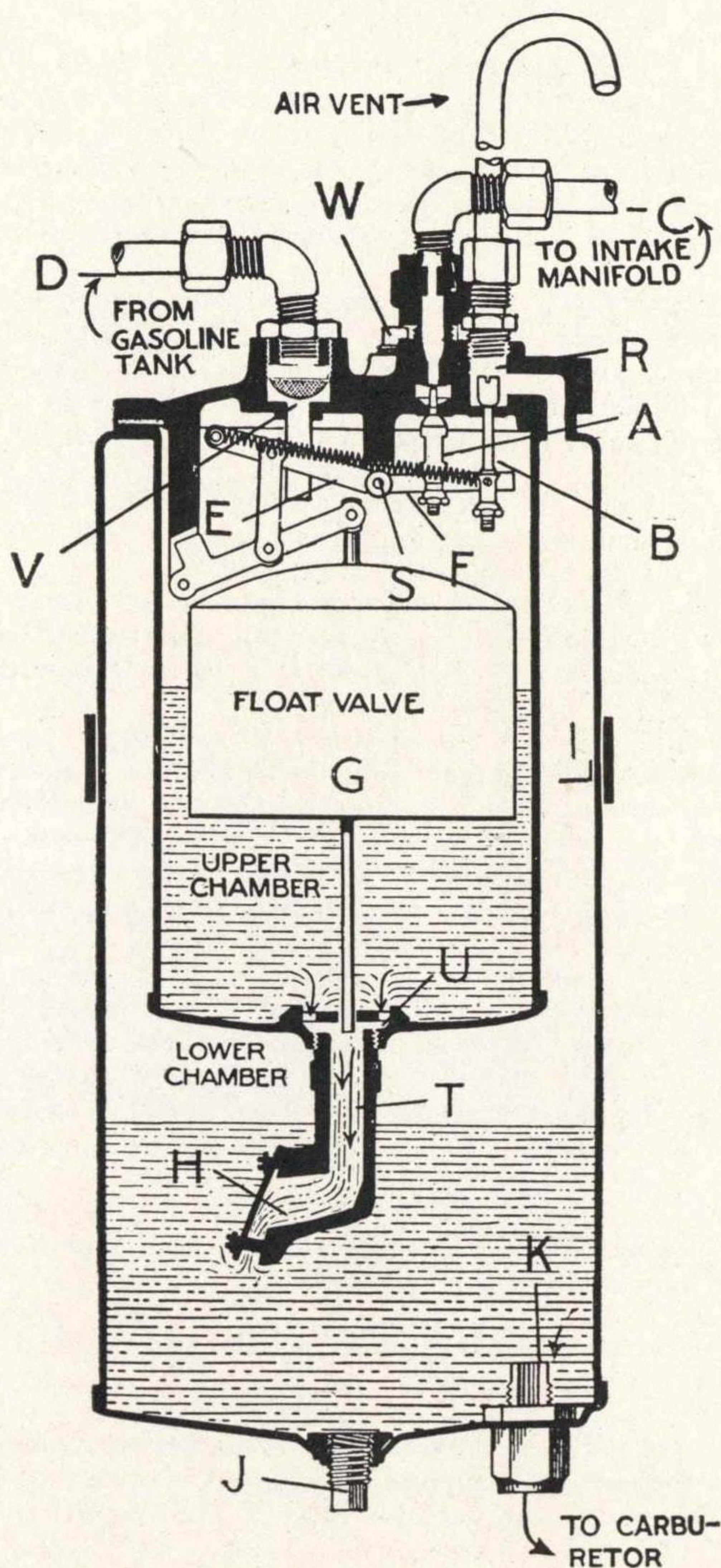
To clean trap, shut off gasoline supply and remove nut S. The gauze may then easily be removed and cleaned.



IN-TAKE SIDE OF ENGINE



EXHAUST SIDE OF ENGINE



(27)

VACUUM GASOLINE SYSTEM

In the design of the gasoline system it has been borne in mind that gasoline is becoming poorer in quality, and every precaution has been taken to insure perfect carburetion though a very low test of gasoline is used. The carburetor has been placed high up on the engine and none of the intake manifold is exposed to the air. The intake manifold proper is within the cylinder casting and the passages are designed so as to be surrounded by water. The heat from the engine is utilized directly and the gasoline mixture is readily vaporized. It passes into the cylinders while hot and there is no chance for losses by condensation. Consequently it is impossible to choke the engine by suddenly opening the throttle. A manifold of this construction makes a wonderful decrease in fuel consumption over the exposed style of manifold.

The gasoline tank is located at the rear of the chassis, where it is not subjected to the intense heat of the engine and where it may be easily filled simply by removing the filler cap. The vacuum gasoline system is used for feeding the gasoline from the tank to the carburetor. This system is not only exceedingly simple, but it also aids in still further decreasing the gasoline consumption, as the feed is always at an even and uniform pressure.

The vacuum gasoline system comprises a small tank about 4 inches in diameter and 8 inches deep, mounted on the engine. This tank is divided into two chambers, upper and lower. The upper chamber is connected to the intake manifold while another pipe connects it with the main gasoline supply tank. The lower chamber is connected with the carburetor.

The intake strokes of the engine create a vacuum in the upper chamber of the tank, and this vacuum, or suction, draws gasoline from the supply tank.

As the gasoline flows into this upper chamber it raises a float. When this float reaches a certain height it automatically shuts off the vacuum valve and opens an atmosphere valve which lets the gasoline flow down into the lower chamber.

The float in the upper chamber drops with the gasoline flowing out, and when it reaches a certain point it in turn reopens the vacuum valve and the process of refilling the upper chamber begins again. The same processes are repeated continuously and absolutely automatically. The lower chamber is always open to the atmosphere so that the gasoline flows to the carburetor, as required, uninterruptedly and with an even pressure.

The vacuum tank is connected at D with the main gasoline supply tank, also at C with the intake manifold and at K with the carburetor. A is the suction valve for opening and closing the connection to the manifold and through which a vacuum is extended from the engine manifold to gasoline tank. B is the atmosphere valve and permits or prevents an atmospheric condition in the upper chamber.

E is a lever to which the two coil springs S are attached. This lever is operated by the movement of the float valve G.

F is a shorter lever which is operated by the lever E, and which in turn operates the valves A and B.

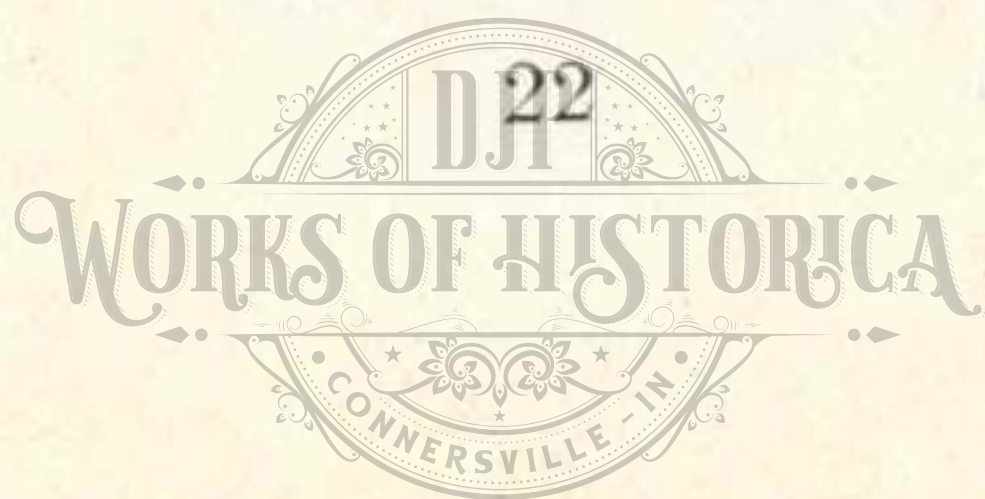
H is the flapper valve in the outlet T. This flapper valve is held closed by the action of the suction whenever the valve A is open, but it opens when the float valve has closed the vacuum valve A and opened the atmospheric valve B.

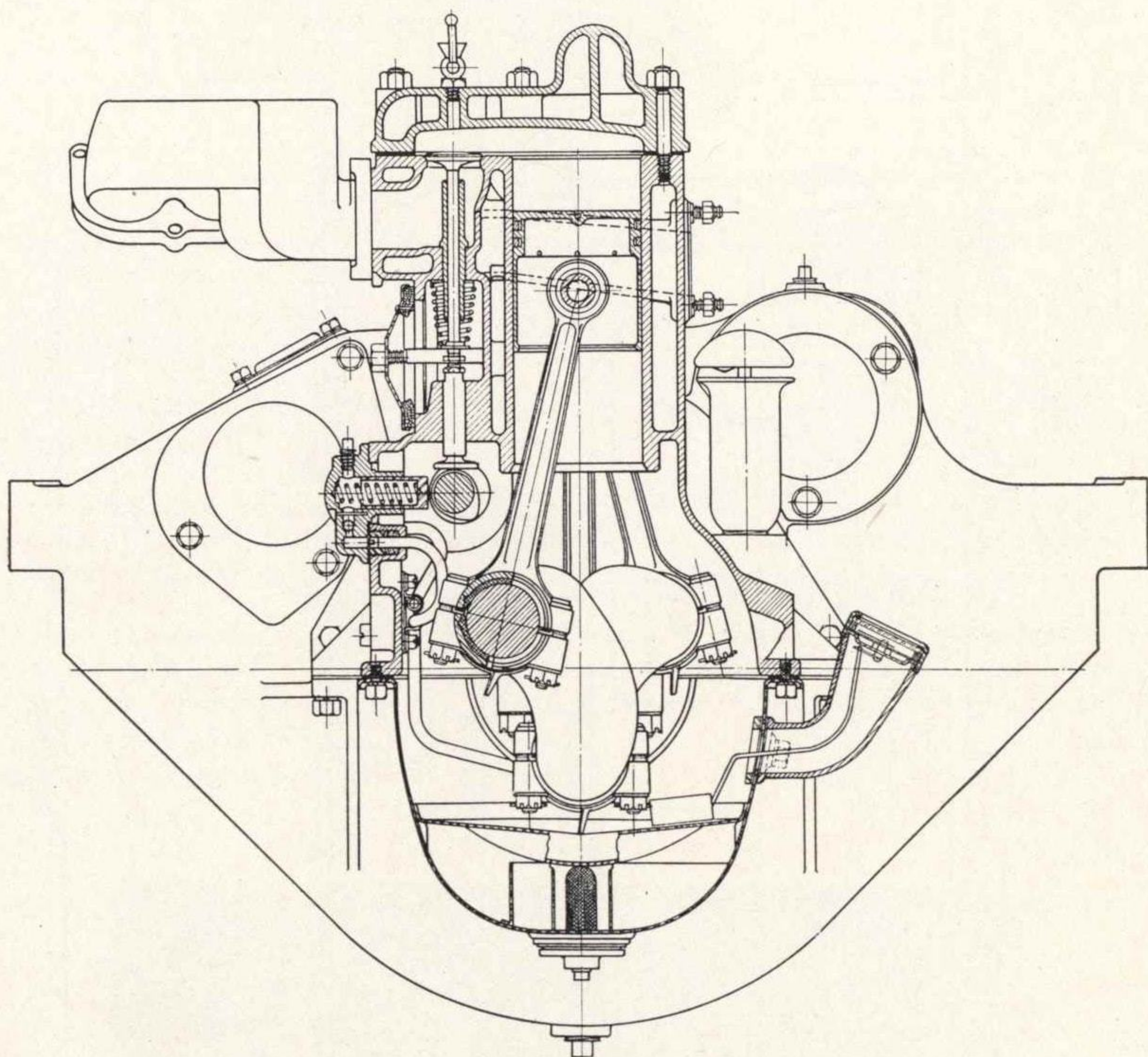
L is the vent pipe, admitting an atmospheric condition in lower chamber at all times and permitting an even, uninterrupted flow of gasoline to carburetor.

R is a screen for preventing dirt being drawn into the tank through the atmospheric valve.

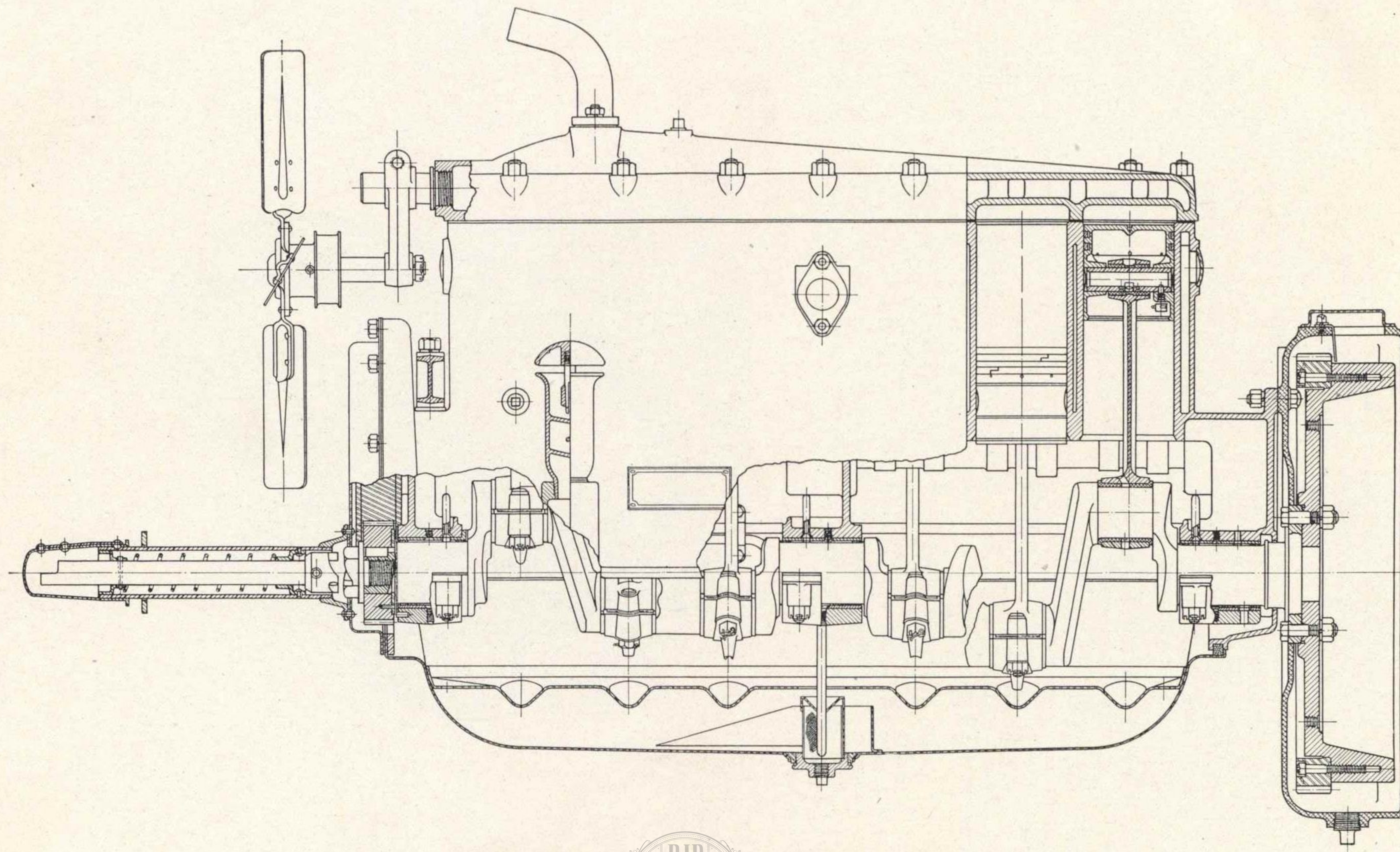
T is the outlet in which is the flapper valve H and located at the bottom of the float reservoir. It can be unscrewed with a screw driver (see slot U) and removed if desired.

It is very important to keep vent in cap open in rear supply tank.



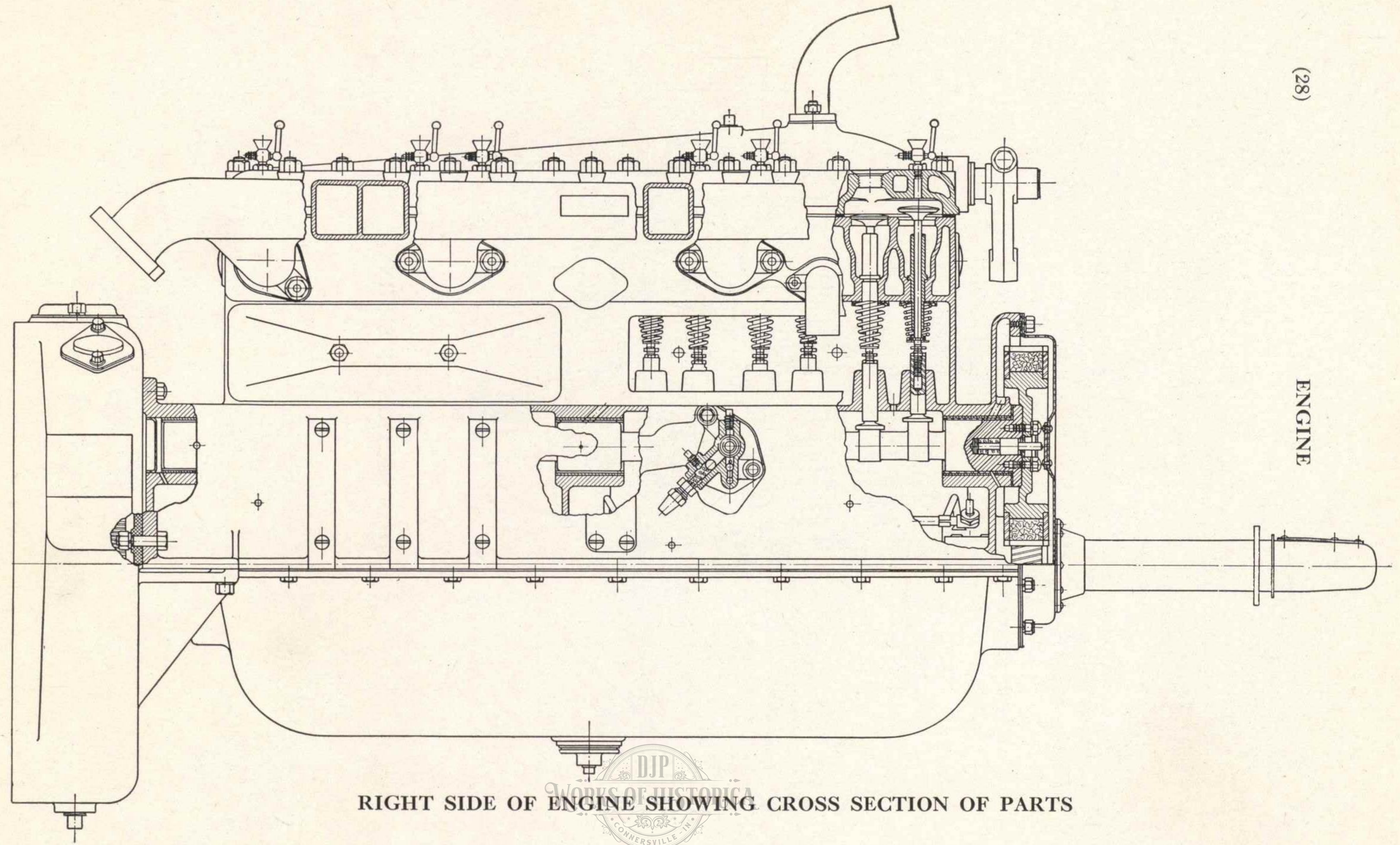


CROSS SECTION OF ENGINE



LEFT SIDE OF ENGINE SHOWING CROSS SECTION OF PARTS





RIGHT SIDE OF ENGINE SHOWING CROSS SECTION OF PARTS



(29)

VALVE TAPPET ADJUSTMENT

The upper ends of the valve tappets or push rods may be observed by removing the two cover plates on the right side of the engine just below the exhaust manifold. There is an adjusting screw in the end of each push rod that is locked by means of a nut. These screws may be raised or lowered to decrease or increase the amount of clearance between the ends of the valve stems and the push rods. The need of adjustment will be made known by a click or sharp tapping noise. Do not allow it to continue. Raise the adjusting screws so that there is .002 or .003 inch clearance between the intake valve stems and push rods and .003 and .004 inch clearance for the exhaust valves. The intake valves are the ones directly under the spark plugs.

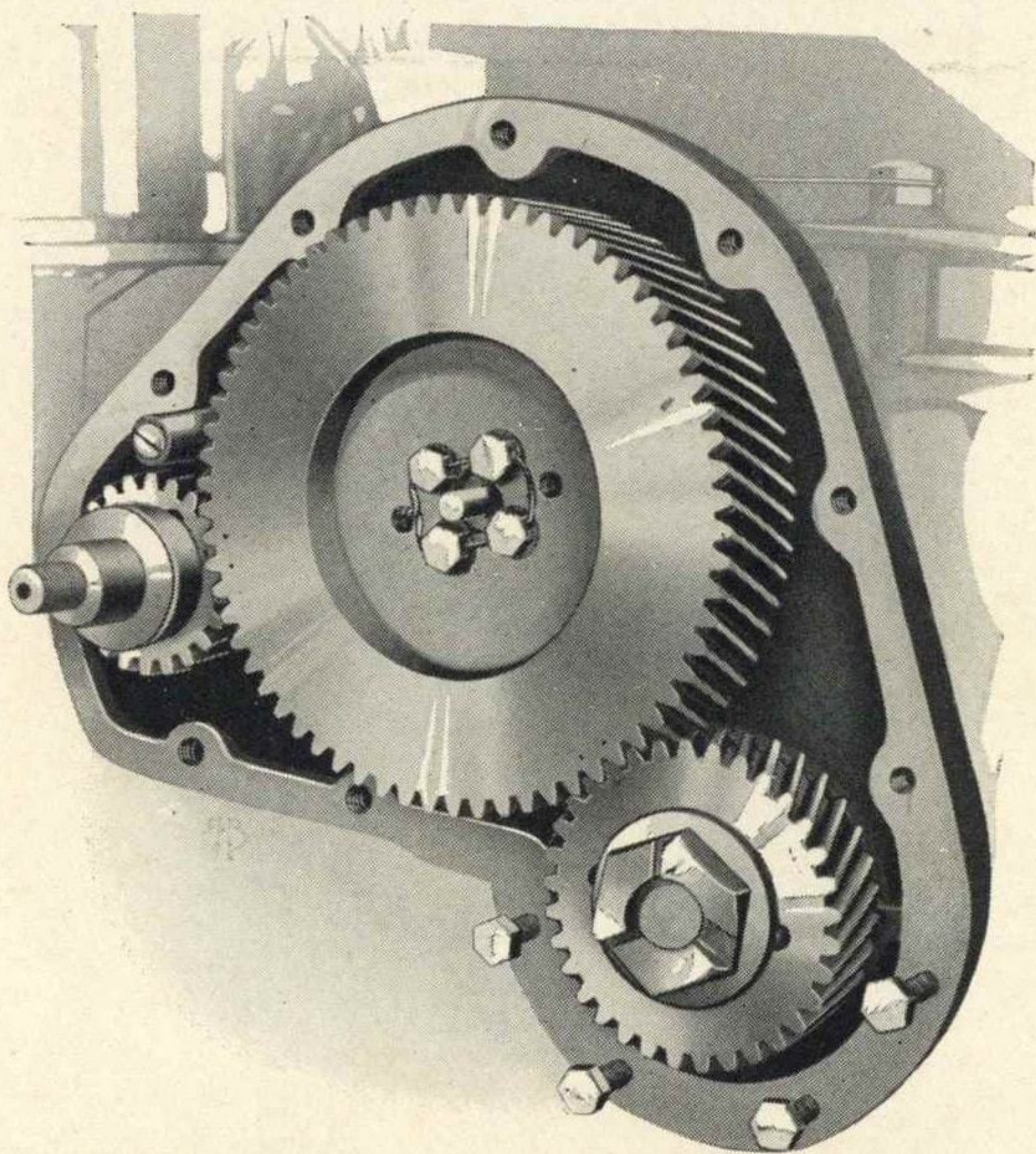
It will be necessary to turn the crank shaft in making these adjustments so that the push rod is free or is not opening or closing the valve when the clearance is measured.

(30)

VALVE TIMING

Cylinder number one is next to the radiator, and the firing order, the order in which the explosion strokes occur in the six cylinders, is 1-5-3-6-2-4.

If for any reason the engine is ever taken apart, it is necessary that the timing gears enclosed at the front of the engine be returned so as to mesh exactly as originally or the valve will not open and close and the spark will not occur at the proper points in the strokes of the engine. The gears are marked correspondingly, so that unless the gears have been removed from the shafts and the markings defaced, the timing will be correct if use is made of these marks.



A marked tooth of one gear should be put in mesh to touch the tooth bearing the same mark of the other gear.

REMOVE ALL WHEELS AND
PACK WITH GREASE TWICE A YEAR

FILL OIL CUPS EVERY WEEK
WITH LIGHT ENGINE OIL

KEEP CUP FILLED WITH
GREASE AND GIVE TWO
TURNS EACH WEEK

GIVE GENERATOR FEW DROPS
GOOD MACHINE OIL EACH WEEK

KEEP RADIATOR FILLED WITH
CLEAN SOFT WATER
DRAIN AND FLUSH OUT EVERY
5000 MILES

DRAIN, FLUSH OUT AND
TO LEVEL OF FILLING
TWICE A YEAR
USE HEAVY OIL

GIVE TIRE PUMP FEW DROPS
GOOD MACHINE OIL EACH MONTH

THESE NUTS SHOULD
DRAWN UP TIGHT TWICE
A YEAR

GENERAL INSTRUCTIONS
SPRING EYES AND BRAKE
FITTED WITH OILLESS BUSH
NEED NO OTHER LUBRICATION
A FEW DROPS OF OIL BETWEEN
CLIPS AND SIDES OF SPRING
SPRING SOUCEAKS
EXAMINE STEERING AND BRAKES
REGULARLY

GIVE STARTING MOTOR FEW
DROPS GOOD MACHINE OIL
EACH WEEK

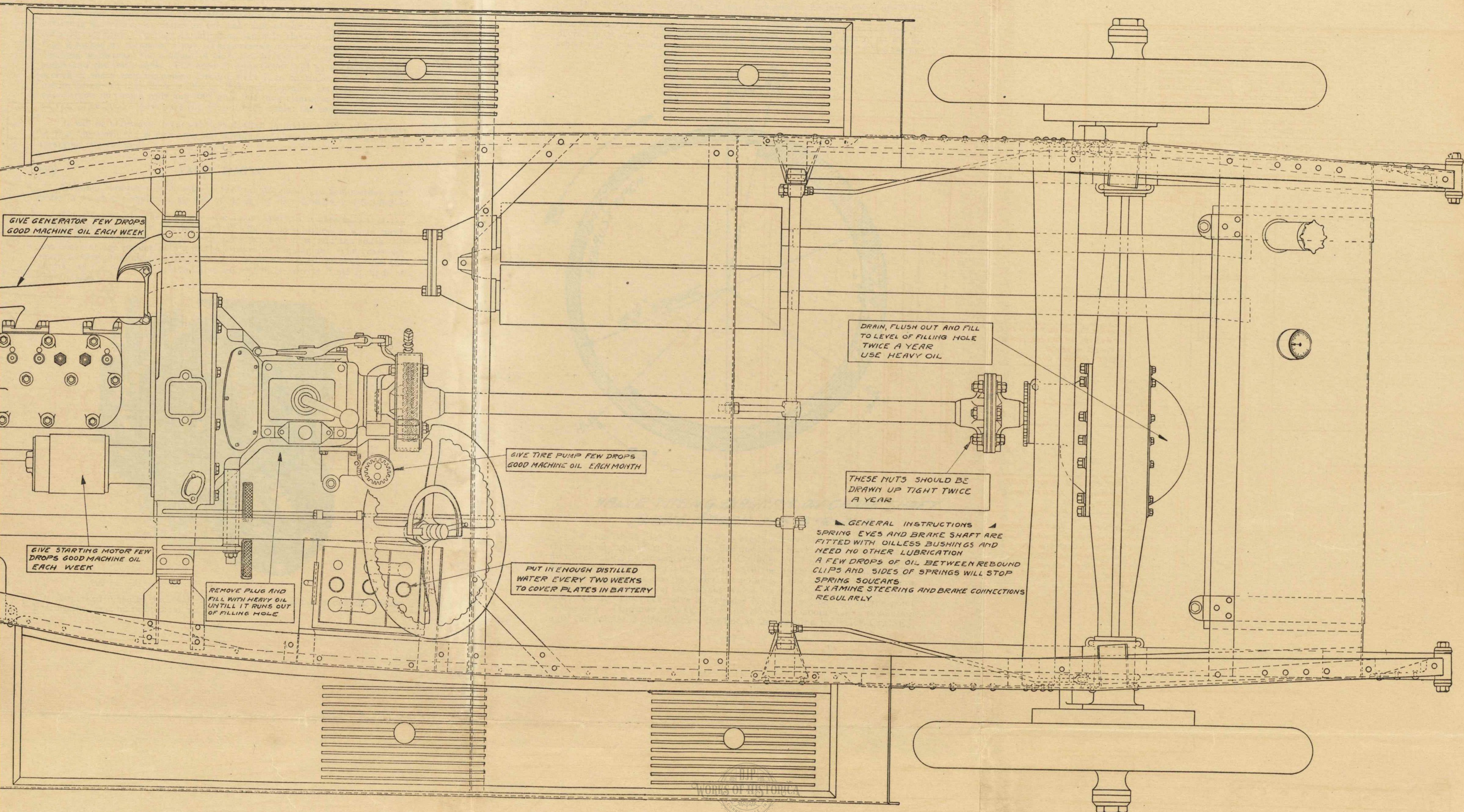
REMOVE PLUG AND
FILL WITH HEAVY OIL
UNTILL IT RUNS OUT
OF FILLING HOLE

PUT IN ENOUGH DISTILLED
WATER EVERY TWO WEEKS
TO COVER PLATES IN BATTERY

REMOVE DRAG LINK AND PACK
WITH GREASE EVERY 5000 MILES

KEEP CUP FILLED WITH
GREASE AND GIVE TWO
TURNS EACH WEEK

ADD TO ENGINE EACH DAY THE
AMOUNT USED THE PREVIOUS DAY
USE GOOD ENGINE OIL
DRAIN OLD OIL OUT AND FILL WITH
NEW OIL EVERY 1000 MILES



GIVE GENERATOR FEW DROPS
GOOD MACHINE OIL EACH WEEK

GIVE STARTING MOTOR FEW
DROPS GOOD MACHINE OIL
EACH WEEK

REMOVE PLUG AND
FILL WITH HEAVY OIL
UNTILL IT RUNS OUT
OF FILLING HOLE

GIVE TIRE PUMP FEW DROPS
GOOD MACHINE OIL EACH MONTH

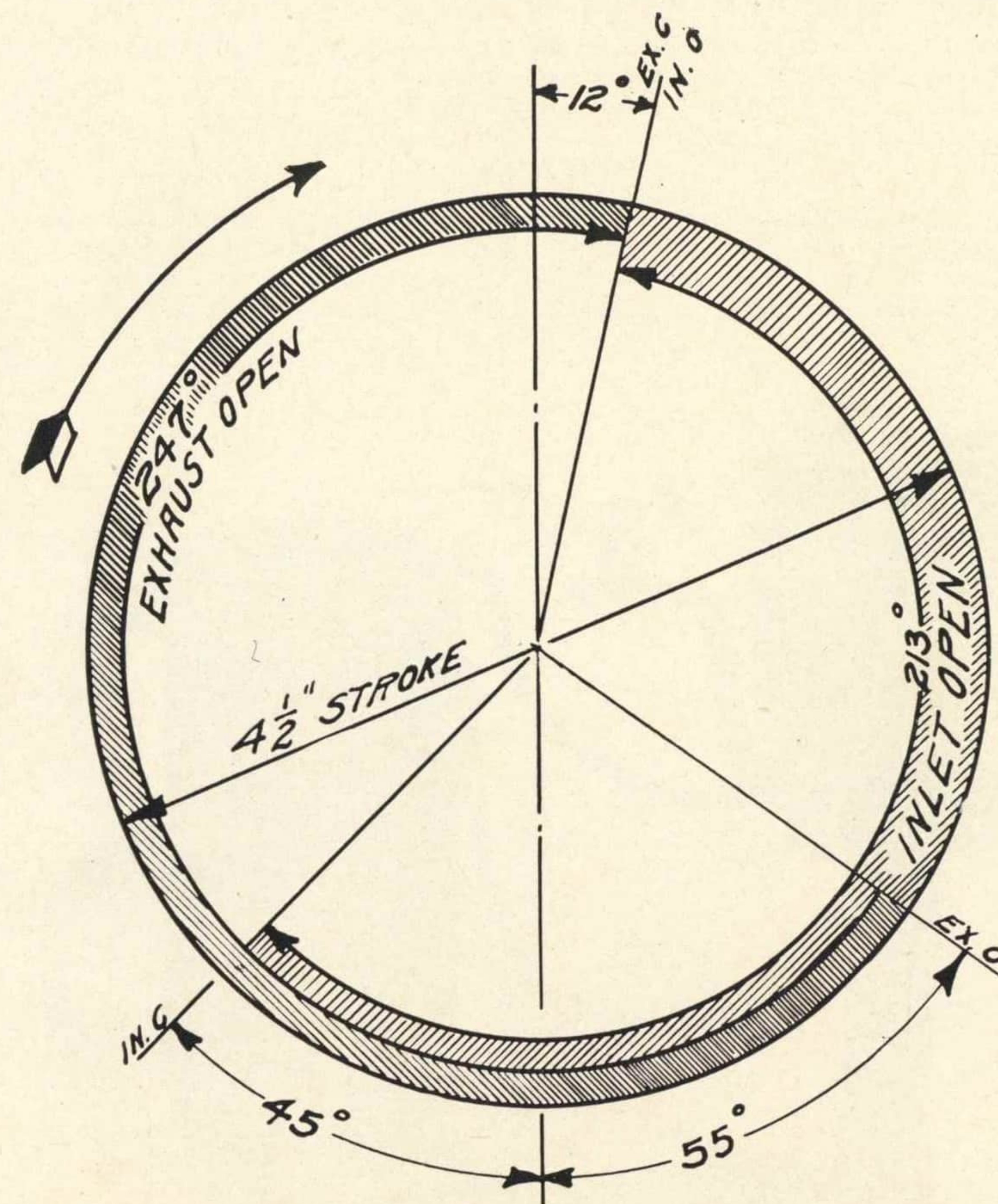
PUT IN ENOUGH DISTILLED
WATER EVERY TWO WEEKS
TO COVER PLATES IN BATTERY

DRAIN, FLUSH OUT AND FILL
TO LEVEL OF FILLING HOLE
TWICE A YEAR
USE HEAVY OIL

THESE NUTS SHOULD BE
DRAWN UP TIGHT TWICE
A YEAR

GENERAL INSTRUCTIONS
SPRING EYES AND BRAKE SHAFT ARE
FITTED WITH OILLESS BUSHINGS AND
NEED NO OTHER LUBRICATION
A FEW DROPS OF OIL BETWEEN REBOUND
CLIPS AND SIDES OF SPRINGS WILL STOP
SPRING SOUCCAS
EXAMINE STEERING AND BRAKE CONNECTIONS
REGULARLY

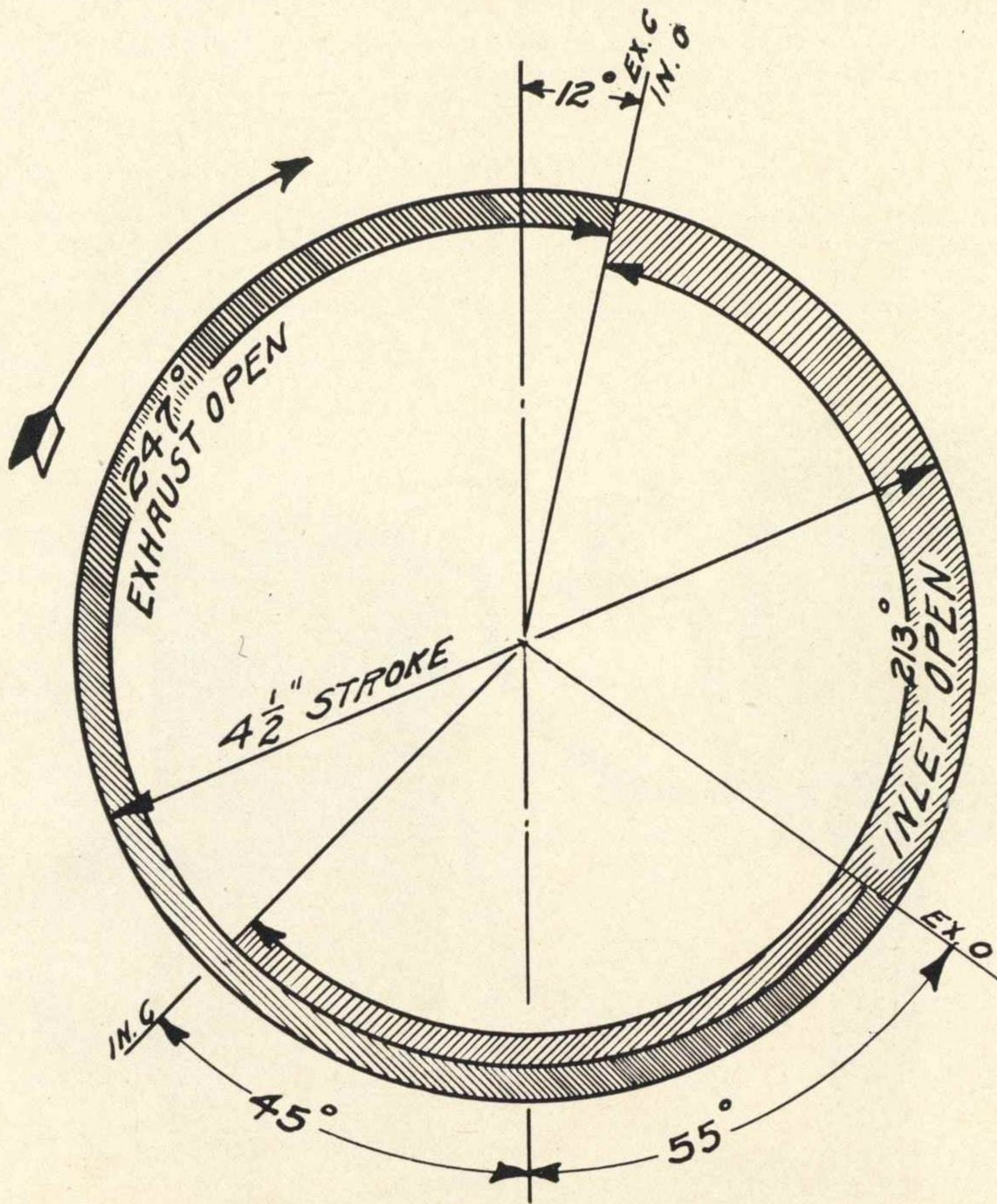
In relation to the turning of the crank shaft, the inlet valve opens 12 degrees past upper dead center and closes 45 degrees past lower dead center. The exhaust valve opens 55 degrees ahead of lower dead center and closes 12 degrees past upper dead center. These points are marked clearly on the fly wheel and can be seen by removing the plate from the top of the fly wheel casing.



**VALVE TIMING DIAGRAM ON CRANK SHAFT
FIRING ORDER 1-5-3-6-2-4**

To time the valves from the fly wheel markings, use the crank to turn the crank shaft and turn it until the line under the marking D C 1 and 6 on the fly wheel is directly under the pointer. Cylinder No. 1 is now on top or upper dead center. Turn the crank slightly until the line under the marking EX-HAUST CLOSES is exactly under the pointer. The cam shaft should now be in such a position that the exhaust valve has just completely closed in cylinder No. 1. The inlet valve in cylinder No. 1 should be just on the point of opening. Continue turning the crank slowly for about half a revolution until the pointer is directly over the line at the marking INTAKE CLOSES.

In relation to the turning of the crank shaft, the inlet valve opens 12 degrees past upper dead center and closes 45 degrees past lower dead center. The exhaust valve opens 55 degrees ahead of lower dead center and closes 12 degrees past upper dead center. These points are marked clearly on the fly wheel and can be seen by removing the plate from the top of the fly wheel casing.



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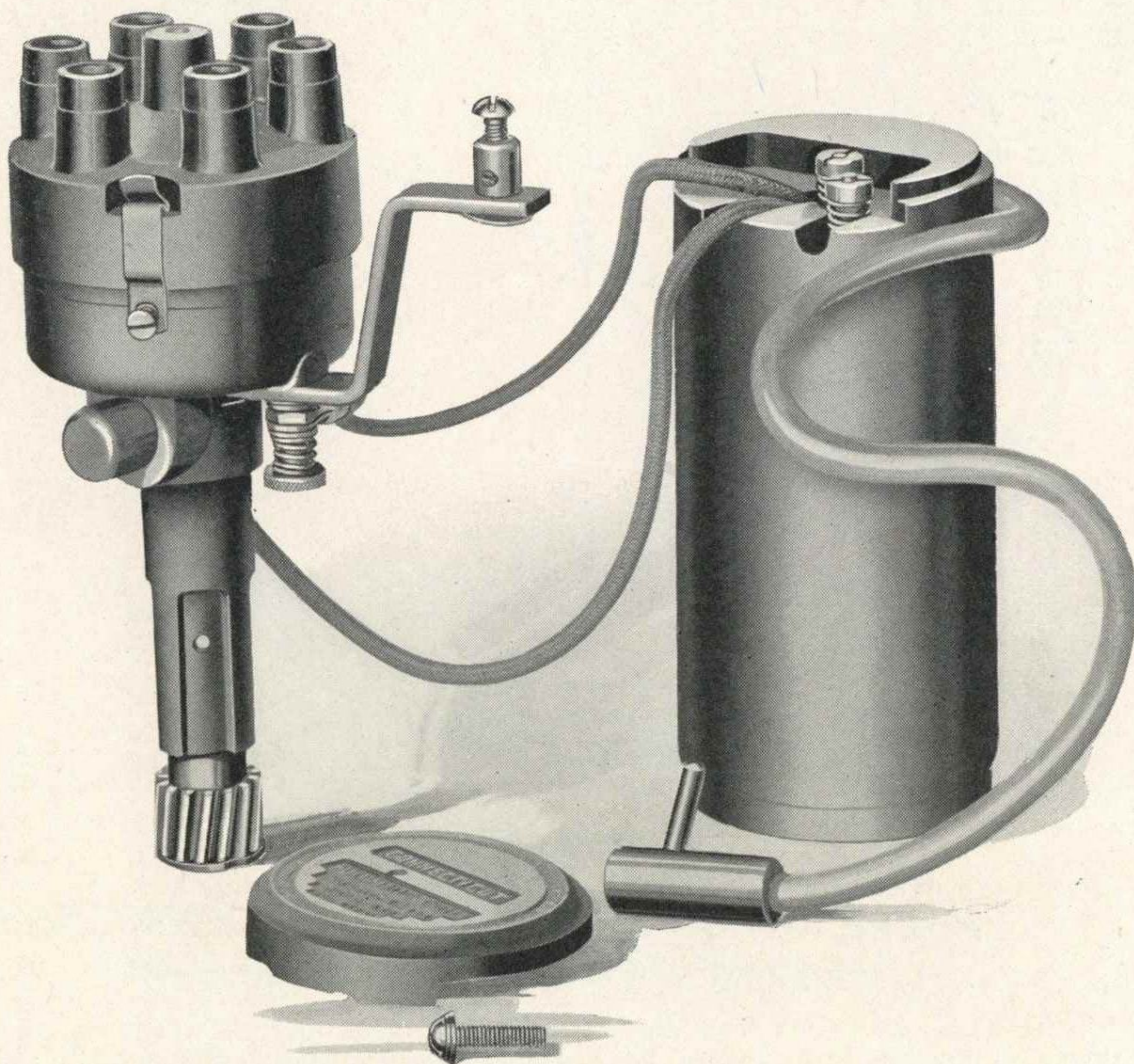
The intake valve in cylinder No. 1 should have just closed completely at this point. Now turn the crank through nearly three-quarters of a revolution until the line on the fly wheel under the marking EXHAUST OPENS comes exactly under the pointer, at which position the exhaust valve in cylinder No. 1 should be just on the point of opening. Turning the fly wheel on around to the position of EXHAUST CLOSES completes the four cycles in two revolutions.

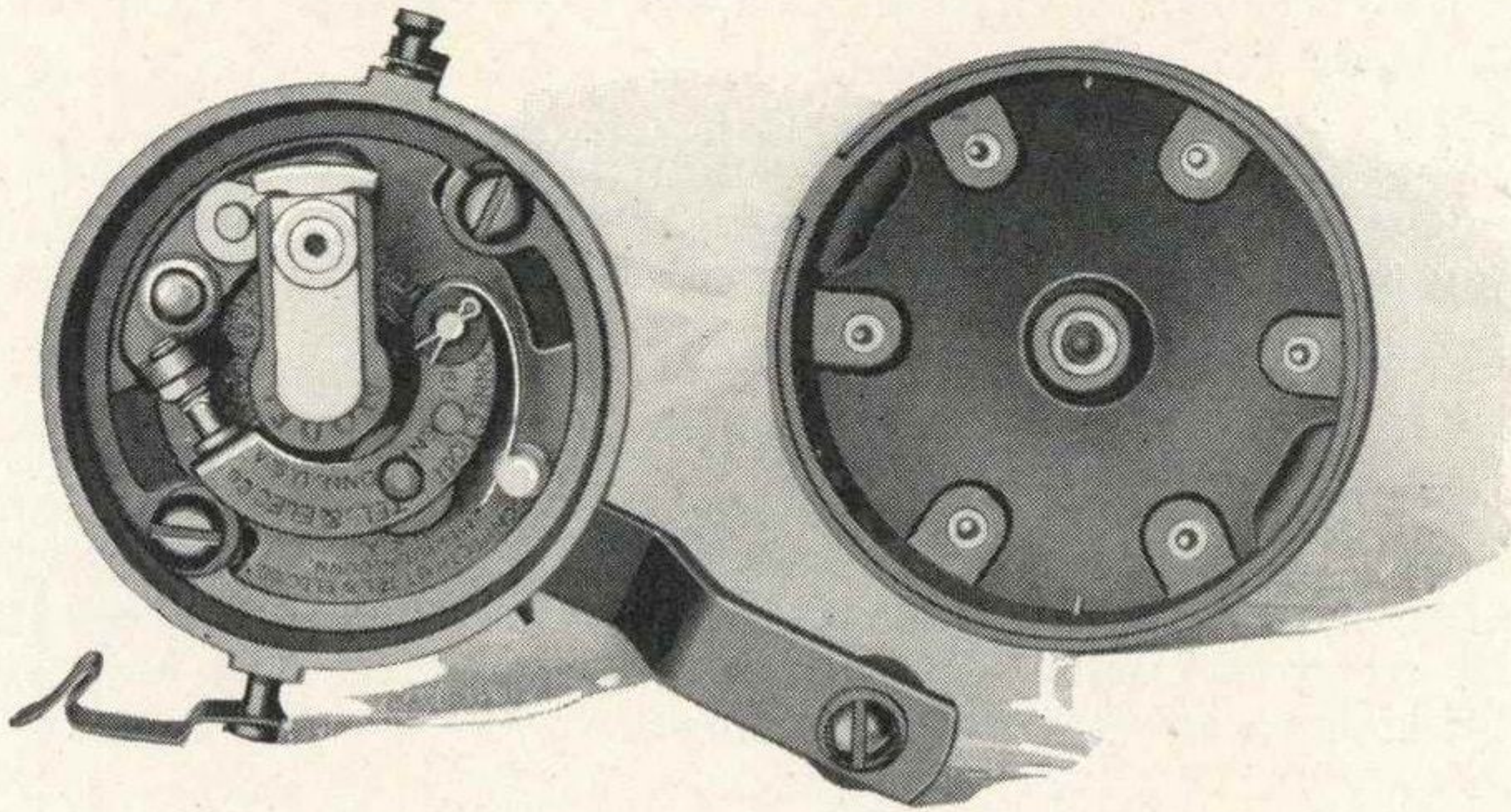
The timing of the valves will be correct only when the valve tappets or push rods are adjusted to give the correct clearance.

(31)

IGNITION

The Connecticut Igniter System produces a single spark upon a break occurring in the primary circuit, which, through being closed, has energized a coil. This "break" is effected in the igniter by means of a cam revolving against a breaker arm. The high tension spark is distributed in the same instrument.





The igniter is mounted on a vertical shaft revolving at half engine speed.

It can be completely disassembled without the aid of tools. Further in actual service it is possible to take the igniter apart while on the car without disturbing the timing and it is absolutely impossible to reassemble it wrong or cause any unintentional variation in the timing.

The breaker arm is heavily insulated from the base and no "ground" is made in the igniter.

The break in the primary circuit is accomplished directly and not through any relay, trigger, spring or cam action which consume time and cause serious mechanical lags which must be compensated for.

The automatic switch of the Connecticut Automatic Igniter System is a feature that is individual to this system and unique in ignition apparatus. Its function is to kick off the switch should the primary circuit be closed an unwarranted length of time, as in the case of the car being left with the switch on and the engine stopped. This will prevent the draining of batteries.



Another purpose is to protect the ignition wiring should a disarrangement occur in the lighting or starting circuit and an excessive and destructive amount of current introduced into the ignition circuit.

As will be noted in the cuts, the switch is operated by push buttons. Pushing the button on extreme right turns on ignition. Pushing the button, next to this on left, turns ignition off. Pulling the two buttons on extreme left of switch, control lights, bright and dim.

The construction is such that no amount of outside vibration or jar can in any way affect the switch.

This automatic "kick off" is accomplished thermostatically and is a mechanism that has been employed successfully for many years in Connecticut telephone switches. It is fully and completely protected by patents covering automobile users.

Unlike the ordinary overload electrical cutout, which operates instantaneously, this device is so arranged that it will not kick off until the circuit has been closed for a short period of time, which allows sufficient opportunity for cranking after the switch button has been pressed. The releasing vibrator is no more complicated than an ordinary electric bell and will operate indefinitely without any attention whatever.

Ignition wires leading to spark plugs should be kept in good condition. Do not allow same to become dirty or oil soaked.

Keep all terminals tight.

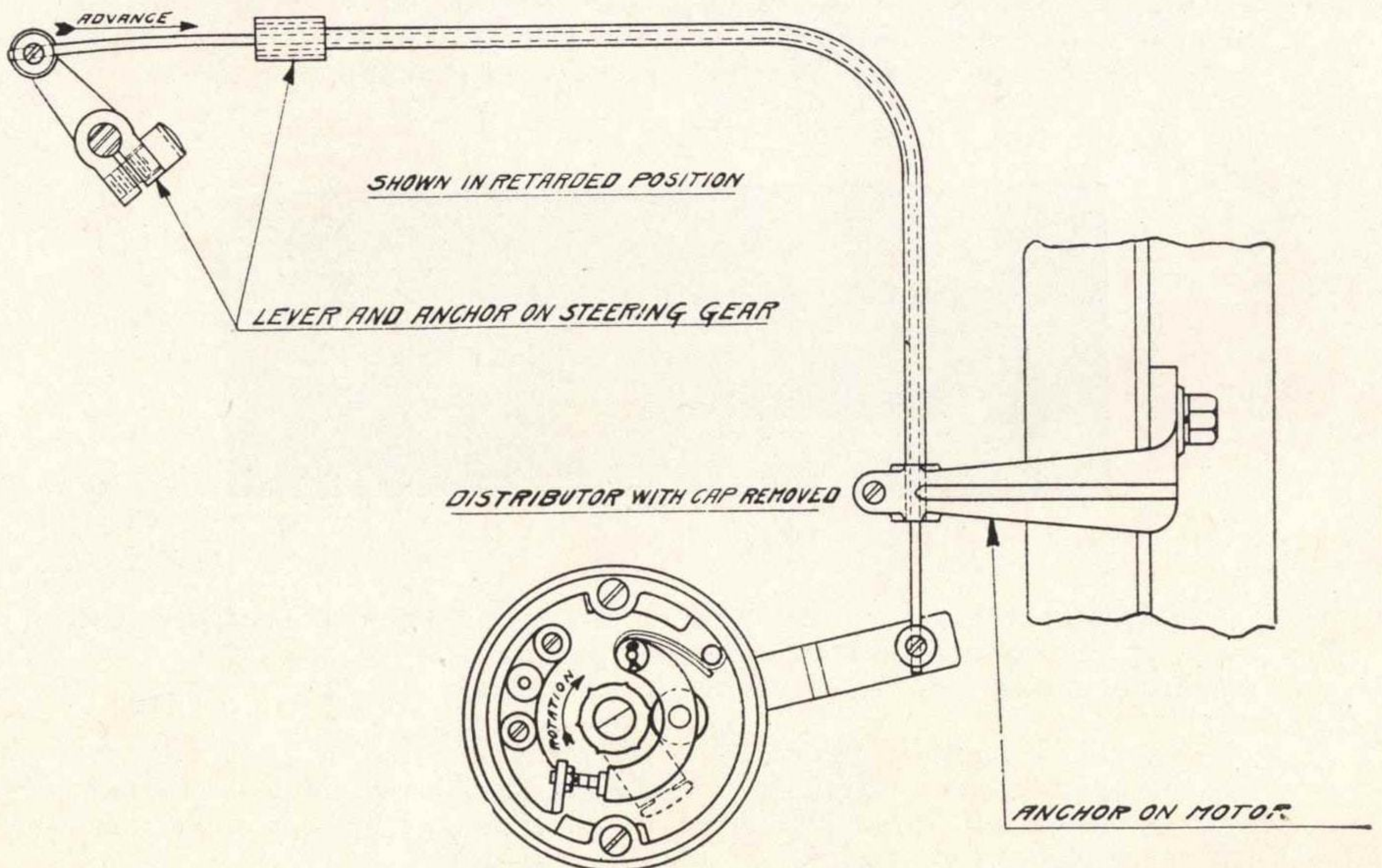
Spark plugs should be examined at any time engine does not fire regularly. If coated over with carbon or soot, take apart, by unscrewing the packing nut, and wipe off porcelains; replace and screw up tight to prevent leaks.

A cheap plug is about the poorest investment you can make. We especially recommend the A. C. plug, made by the Champion Ignition Company, Flint, Michigan.

(32)

IGNITION TIMING

To time the ignition correctly, open pet cock on No. 1 cylinder (next to radiator), by means of starting crank turn motor slowly until you get compression, which can be determined by holding your thumb or finger on pet



cock. Be sure not to pass upper dead center. Same can be determined by mark on fly wheel, D, C-1 and 6, through opening on top fly wheel housing exposing the pointer or indicator. Retard the spark lever on steering column fully, remove the distributor cap on igniter—note the position of the breaker points. They should be just ready to open or separate. By advancing spark lever on steering column a slight bit should cause a spark to jump if the current was turned on.

If it is found that the points do not separate (to cause a spark) with a movement not to exceed one inch of spark lever, the spark is timed too late and should be set to occur earlier. Loosen clamp screw that fastens the shifter wire to the arm on igniter head. Move this arm towards center of motor as far as it will go. Next loosen the set screw that holds igniter head in position on motor, then rotate the head anti-clockwise by pushing the arm until the cam just strikes the roller, and breaker points just show opening. Tighten screw to hold igniter head in this position firmly without binding the center breaker shaft, and lock the screw with the lock nut. Tighten the clamping screw on the shifter wire. Replace distributor block and cap.

(33) **TIRE PUMP**

An engine-driven tire pump is included in the equipment attached to sides of transmission to assist the owner in keeping his tires properly inflated. Hose long enough to reach any tire on the car and an attached gauge for ascertaining the exact pressure are also furnished.

To use pump, connect up the hose to the tire and with the lever throw the gear in mesh. This can be done while engine is running. When the gauge shows the proper pressure, throw out pump and read the gauge again. It is very likely that the pressure then indicated will be less. Start the pump again and allow it to run until the correct pressure is indicated when it is stopped.

The proper lubrication of the pump is important. Piston is lubricated by rubbing against an oil-soaked wick. About ten drops of oil once a month is sufficient. A few drops applied to crank shaft every four and five inflations is necessary. Tire pump is located on side of transmission under front floor board.

(34) **TIRES**

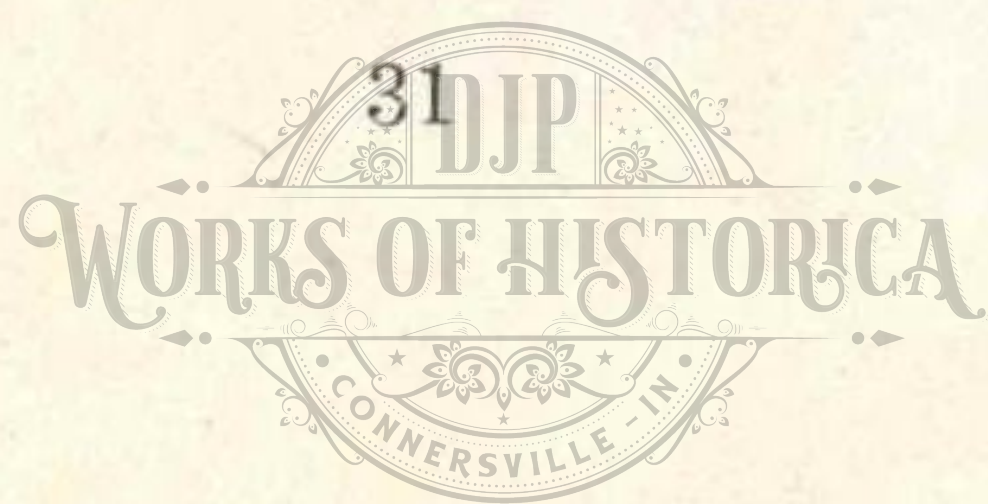
At the present time the tires are the most expensive item in the maintenance of a car. They are at the same time susceptible to more wear than any other part of the machine. Careful driving is the greatest factor in prolonging their life. It should be borne in mind that all sudden stops and starts, skidding, rapid running over rough roads, and, in fact, careless driving of all kinds, are to be avoided whenever possible.

The trouble attendant upon driving with the tires only partially inflated is also serious. The tire, when run while soft, is heated to an extraordinary degree, causing disintegration of the fabric and rubber and breaking down the structure. Always keep the tires inflated to their capacity. This precaution should be rigidly observed.

Oil and grease attach rubber and should be immediately removed if any is discovered on the tires.

(35) **HOW TO SAVE ON TIRE BILLS**

There are three ways in which you can save on tire bills: First, by keeping the tires at all times well inflated; second, by using your breaks with caution; and third, by not overloading the car. More than three-fourths of all tire trouble is caused by under-inflation; that is, by running the car on tires that



are too soft. A soft tire, by having its sides bent at a sharp angle, will soon have its fabric loosened from the rubber with consequent liability of an early rupture. Besides, a hard tire presents less surface to the road and is therefore less likely to suffer cuts and punctures.

The rear tires support more weight than the front ones; they also have to bear the strain of pushing the car forward, and for these reasons they are subject to more wear than the front tires. Many motorists follow the practice of using repaired tires on the front wheels and new ones on the rear wheels.

It is not a commendable practice to drive on street car tracks, because the sharp edges of the rails will soon put their marks on the casings.

Before "stabling" your car at night, examine your tires and remove small pieces of glass, little nails, etc., that may have become lodged in the rubber. Next day they are apt to work their way through into the casing and cause a puncture of the inner tube.

Keep all oil and gasoline away from your tires; they are solvents of rubber and will cause tires to rot.

When making a stop, select, wherever possible, a dry place for your car to stand upon.

Spare tires should be kept in a place where they are not subjected to light, heat or rapid changes in temperature.

Nothing will wear a tire faster than sudden locking of the rear wheels and turning corners at considerable speed. Use your brakes with judgment and turn corners slowly.

When a tire is worn at the tread, or when it develops sand blisters or mud boils, it is best to change it in time and have it re-treaded. This operation will make it available for considerable more service, whereas when allowed to run down too much the carcass of the tire will become so weakened that a re-treading of the casing will prove poor economy.

Never allow a tire to wear until the canvas fabric becomes injured, because the wall of the tire is apt to become too thin to prevent pressure of the inner tube from bursting through the weak portion. Remember that the strength of the tire is in the fabric. The rubber is merely a binder which unites the various layers of fabric and forms a covering over the whole.

Carry an extra casing. It is so much simpler to change a tire than to repair an old one. Extra casings should be carried in a tire covering securely fastened to the car.

Don't pump your tires merely by guess work. Use a tire gauge and make it a point never to carry less pressure than is recommended by the makers.

Always sprinkle some French talc or soapstone into the casing when changing a tube.

Carry a few spare valves and valve caps.

(36)

REPLACING INNER TUBES

When taking an inner tube out, turn the wheel until the valve stem is at the bottom and remove the tube, beginning at the top.

Always make it a point to run your hand around the inner side of the casing until you detect the cause of the puncture, because very often the offending object is hidden in the tire and cannot be seen or felt from outside.

Put in a new tube or patch the old one; the inserting of the tube may be done with the casing remaining on the rim or with it removed. In either

case it is desirable to turn the wheel until the valve stem hole is on top. Before the side flanges are replaced, the inner tube should be partially inflated.

Then run your hand around the inner tube, smoothing out the creases and placing the tube evenly around the rim.

Do not inflate the tube too much, for if you do you will have difficulty in replacing the locking rim over the bead of the casing.

Inflate the tire carefully and test the increasing pressure with your hand.

Occasionally the tube is pinched under the valve base. Push the tire valve up with your hand before inflating. When the valve returns to its original position there is no danger of pinching.

(37) **REPAIR OF TIRE CASINGS**

A hole in the tire casing is serious only when it is large enough to let the inner tube be blown through it. Usually this occurs with old tires which have been in use so long that the rubber tread has worn off and the fabric is weakened. In such cases no repairing will be satisfactory.

If there is a cut in the casing that is otherwise in good condition, a temporary repair may be made and will stand many miles of running. Such repair consists of attaching a patch of one or two thicknesses of heavy canvas to the inside of the casing, in addition to which a blow-out bandage may be used on the outside. Material for such patches may be bought of any tire maker; it is known as friction cloth and is made of heavy canvas with a dressing of rubber cement on one or both sides.

The inside of the casing around the cut should be scrubbed clean with gasoline, and when it is thoroughly dry, three coats of cement should be applied. Cement should also be applied to the cemented side of the friction cloth and the cement on the casing and on the patch should be permitted to become "tacky," as in the case of repairing a tube. The patch should extend several inches on each side of the cut and should line the casing from bead to bead.

This, of course, is but a make shift. For permanent repairs the casing should be "vulcanized;" this requires special apparatus.

(38) **MATCH THE TIRES**

Make it a point always to use tires of the same diameter. If there be a difference, this will cause unequal traction and the differential gears will not work evenly, though both gear wheels drive on even ground. If the use of different sized tires cannot be avoided, you had better use them on the front wheels. It is much better to have a 34x4 and a 35x4½ tire in front than on the driving wheels.

(39) **CEMENT SMALL CUTS**

It pays to go over all tires frequently, picking out any bits of gravel or metal which may have become imbedded in the surface. The small cuts which they leave should be sealed with a good cement and a specially prepared "plastic," which may be purchased from all tire concerns.

(40) **A WORD OF WARNING**

Don't experiment with any of the many kinds of solid, semi-solid, etc., tires. It is absolutely agreed that a substitute for the pneumatic tire has not yet been found and that no purely mechanical device can ever attempt to approach in resiliency the pneumatic tire, which uses the most elastic shock-absorbing medium known in nature, namely, air.

(41)

ROADSIDE REPAIR OF INNER TUBES

Do not attempt to patch tubes, except when there is no other recourse. If the puncture is a small one it may be located by inflating the tube partially and turning it around in a tank of water. Bubbles will indicate the exact location of the leak. Moistening the suspected spot with saliva will have the same effect.

Mark the leak with a pencil, if possible, then clean the spot around the leak with gasoline. After this, both patch and the portion of the tube around the leak should be sandpapered until all the sulphur bloom has disappeared, and both surfaces show the raw rubber. Care must be taken that the sandpapered spot of the tube is somewhat larger than the patch itself. Apply the tire cement to both patch and tube, allowing it to dry for a few minutes until it becomes "tacky," and finally put on the patch and squeeze it even. Press it between two flat surfaces or stand on it until it is dry. The patching operation may now be somewhat simplified by the use of "quick patches," which need only to be moistened with gasoline and put on the previously sandpapered surfaces. Sprinkle the patched spot with soapstone. The cement patch is not a permanent repair and the tube should be vulcanized as soon as possible for perfect safety.

Before proceeding to patch a tube it is wise to examine it thoroughly to see whether there are any other punctures besides the one you noticed first.

In many cases a slow leak that is supposed to be due to a puncture may be traced to a leaky valve. To ascertain this, turn the wheel so that the valve is at the top and the valve stem hanging downward. Fill a glass full of water and hold it so that the valve stem projects into it. Air bubbles will show a leak due to weakness of the valve. A renewal of the inside valve parts will set things right.

(42)

HANDLING INNER TUBES

To fold an inner tube in the most satisfactory manner, the detachable part of the valve should first of all be removed so that the air may easily escape during the later operations.

The tube should be rolled up as tightly as possible, beginning at the end farthest from the valve. A large part of the air is thus driven out through the valve, but owing to the bend at the unrolled end it will accumulate there. To get rid of it, hold tightly the rolled part with the left hand and draw the opposite end to the rear from time to time. Continue to do this until the tube is completely rolled.

Still holding the tube as tightly as possible, insert the valve parts and put on the cap; screw it down as tightly as possible with the fingers, but on no account use the pliers.

The tube is now perfectly flattened and its insertion in the casing, when necessary, is greatly simplified; at the same time it is protected from pinching or injury from a lever or tire tool.

The next step is to open the tube out again with the valve in the center and uppermost. Now fold each end of the tube inward toward the valve, making the flat package, which may be secured by a couple of rubber bands cut out of an old tube, or with a piece of tape.

If the tube is punctured or without a valve, it is useless to attempt to fold it, for although the air may be driven out, it will enter again by the hole or through the valve as soon as pressure is removed.

If you keep your spare tubes in a compartment together with oil cans, tools, etc., it is best to place each tube in a bag, into which a handful of soapstone may be thrown; in this manner the tube prepares itself automatically for being mounted in the casing.

(43)

RADIATOR COOLING SYSTEM

If the radiator be kept full of clean water at all times there will never be any trouble experiences from over-heating due to the circulation system. The water passages in the jacket surrounding the cylinders are unusually large. Rain water should be used by all means if available. Any well water contains more or less lime and mineral compounds in solution that leave a scale or sediment inside the radiator and jacket which greatly hinders the free transmission of the heat from the cylinder walls to the water. If such water must be used the entire cooling system should be cleaned at frequent intervals by mixing up a solution of one pound of ordinary washing soda to about five gallons of water and allowing the solution to remain in the system for about an hour, and then flush out thoroughly. It is just as important that the external surfaces of the radiator be kept clean. A quick adjusting device is provided to keep the fan belt tight. Keep the belt just tight enough to prevent the belt from slipping.

When the first freezing weather comes, the greatest care should be exercised to prevent the freezing and bursting of any part of the cooling system. The water may be drained out entirely when the engine is stopped, or better, a solution of some sort used that will not freeze at ordinary temperatures. In draining the water, open both the pet cock under the radiator and under the pump and cylinder block. Allow the engine to run a few minutes after the water is drained out so that all remaining drops of water will pass out. Denatured alcohol and water furnish about the most practical solution that can be used to prevent freezing. The following table is based upon percentages by volume:

(44)

ALCOHOL AND WATER TO PREVENT FREEZING

Percentage By Volume

Water, 95%; Denatured Alcohol, 5%	Freezing Point, 25
Water, 90%; Denatured Alcohol, 10%	Freezing Point, 18
Water, 85%; Denatured Alcohol, 15%	Freezing Point, 11
Water, 80%; Denatured Alcohol, 20%	Freezing Point, 5
Water, 75%; Denatured Alcohol, 25%	Freezing Point, — 2
Water, 70%; Denatured Alcohol, 30%	Freezing Point, — 9
Water, 65%; Denatured Alcohol, 35%	Freezing Point, —15
Water, 60%; Denatured Alcohol, 40%	Freezing Point, —23

The alcohol will evaporate before the water does and care should be used that the solution is kept up to the proper density for the existing temperature. Alcohol will have to be added from time to time.

(45)

WATER PUMP

On both the front and rear sides of the water pump will be found a packing box or gland. The packing is placed around the shaft and then drawn in tightly by means of the collar. This packing should be well covered with a mixture of oil and graphite to provide lubrication as well as to prevent water leaks.

(46)

WESTINGHOUSE ELECTRIC STARTING MOTOR

The Westinghouse starting equipment with mechanical pinion shift consists of an electric motor, a starting switch and an automatic pinion-shifting device.

(47)

—Automatic Screw Pinion Shift—

In the automatic screw pinion shift the starting motor is fitted with a special threaded shaft which automatically shifts the pinion into mesh with the fly wheel when the starting switch is closed.

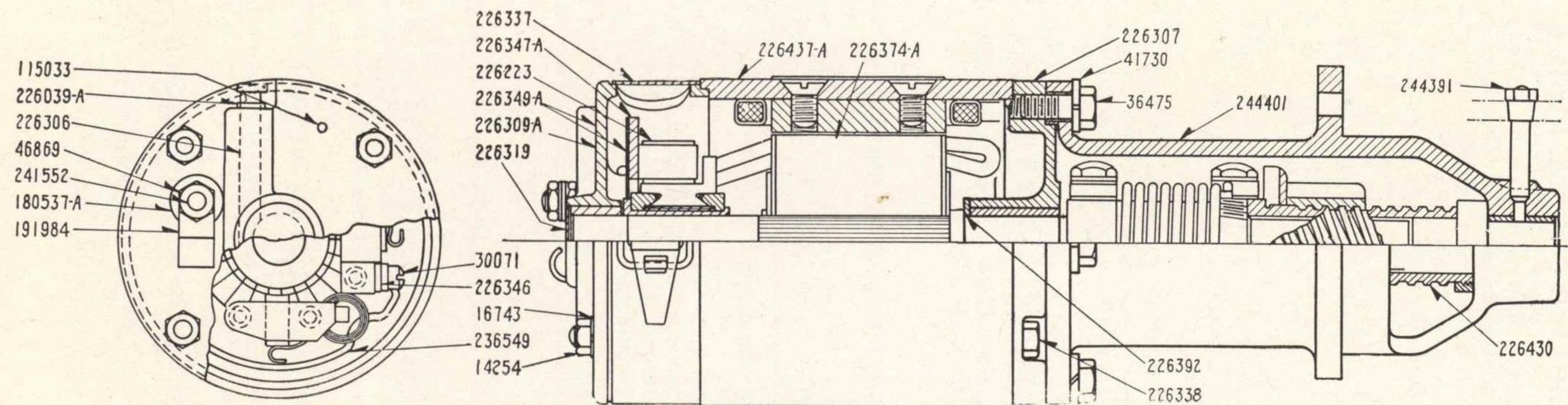


DIAGRAM OF AUTOMATIC SCREW PINION SHIFT

When the starting switch is closed, the full battery voltage is impressed on the motor, and it starts immediately. The pinion, when the motor is at rest, is within the screw-shift housing and entirely away from the fly wheel gear. The threaded shaft is connected to the motor shaft by a spring which thus forms a flexible coupling. As the load is not large enough to compress the spring when the motor starts, the threaded shaft is immediately revolved by the spring in released position. The pinion moves out on its shaft by virtue of the revolving threads, until it reaches the fly wheel. If the teeth of the pinion and fly wheel meet instead of meshing, the spring allows the pinion to revolve until it meshes with the fly wheel. When the pinion is fully meshed into the fly wheel teeth, the spring compresses and the pinion is then revolved by the motor as through a continuous shaft, turning the engine over. When the engine fires and the fly wheel peripheral speed continuously exceeds that of the driving pinion, it forces the latter out of mesh and it is returned to its original position in the screw shaft housing. During the periods immediately after the engine has passed over any one of the points of maximum compression, the spring offers an elastic cushion between the fly wheel and the reduction gear so that the pinion will not be thrown out of mesh.

(48) **—To Start the Engine—**

Make sure that the gasoline and ignition are turned on. Press down the starting button on floor board near seat. As soon as the engine runs on its own power, release the starting button quickly. The engine should pick up immediately. If it fails to pick up within five seconds, the starting button should be released.

(49) **—Emergency Use—**

The starting motor will run the car (preferably on low gear) a short distance in an emergency. However, the battery is not intended for this purpose and if so used will deteriorate rapidly, especially if allowed to stand without being at once fully recharged to gassing.

(50) **—Oiling—**

The motor has ball oilers; each of the oilers should be given three to four drops of the best grade of machine oil once every month.

(51) **—Commutator and Brushes—**

Examine the commutator occasionally by removing the spring collar over the brushes. Keep the commutator free from dirt or oil, cleaning, when dirty, with a cloth (not waste). When the commutator and brushes are in good condition they will show a glaze, and the commutator will be chocolate brown in color. If rough, they can be smoothed up with fine sandpaper, but do not use emery paper.

The brushes should not be removed except in case of trouble. To remove brushes, lift the spring that holds the brush in the guide and take out the screw holding the brush shunt, then the brush can be slipped out. In removing each brush it should be remembered which side was turned up, and each brush should be replaced in its original holder with the proper side up. In putting in new brushes, care should be taken to see that they have a good bearing-fit on the commutator. The original brushes are long enough to last almost indefinitely.

(52) **—Starting Switch—**

Do not put oil on any part of the starting switch. In the switch for automatic pinion shift the moving contact should close firmly against the stationary contacts, and the return spring in the switch should open the contacts at least $\frac{1}{8}$ -inch when pressure is removed.

(53)

—Adjustment of Bearings—

If for any reason a bearing has to be removed and replaced, the adjusting cover plate should be screwed in to exactly the same position and the stop inserted in the same hole as originally.

(54)

—Location of Troubles—

Surprisingly few troubles have been experienced with the Westinghouse starting systems; and of the troubles that have occurred, by far the greater part have not been due to the electric system, but to failure of gasoline, carbonized spark plugs, etc. When trouble does arise it is desirable to locate it as quickly as possible. To assist in doing this we give below the troubles that could occur with this system, and the possible causes of each, although very few of these troubles will ever be experienced. In locating the cause of the trouble, check up the various points in the order given, as the most likely cause, and the one most easily tested is given first.

If starting motor fails to start at all when starting button is pressed down as far as it will go, test out the troubles as follows:

(a) Battery run down or battery solution low. Fill with water and recharge.

(a-1) Battery defective. This is probable if battery has been operated for considerable periods in nearly discharged condition or with plates exposed above the solution. Battery should be repaired.

(a-2) Loose, rusty or corroded connections at the battery terminals or battery ground connections.

(a-3) Accidental ground at brush shunts, or motor, or switch terminals.

(b) Examine the starting switch to see that connections have not worked loose in such a way that the switch does not operate.

(b-1) Look for a broken wire or loose connection in the circuit from battery to starting switch; from switch to starting motor; from motor to ground; from battery to ground.

(b-2) Remove spring collar over the brushes; see that the brushes and commutator are in good condition and not sticky with oil and that brushes are making contact with commutator.

If motor rotates but engine does not, the pinion may fit too tight on its shaft, the threads may be clogged, or the pinion shift spring may be broken.

If motor rotates until the pinion meshes with the fly wheel and then it stops rotating, the engine or some of its auxiliary parts may not be moving freely, due to improper lubrication, etc., or the battery may be discharged.

If engine does not pick up immediately after two or three trials, though the motor turns the engine over, the trouble is in

(a) The gasoline supply.

(b) The spark plugs.

(c) The carburetor.

(d) The ignition system.

If starting motor continues to run after the switch lever is released, see that the return spring on the switch or switch lever is strong enough to return the parts positively and fully to the "open" position.

—Repairs—

Repairs and Responsibility Therefor.—In case any difficulty arises that cannot be readily located, notify the dealer from whom the car was purchased or an authorized representative for the make of car. The Westinghouse Electric and Manufacturing Company will not assume responsibility for repairs attempted by unauthorized parties, or assume any guarantee obligation for the upkeep of any apparatus or parts supplied by the automobile owner or unauthorized parties. In case the dealer is unable to correct a difficulty which he assumes is due to fault in the Westinghouse equipment, he will request help from the Westinghouse Service Department.

In ordering repair parts always give the size and serial number stamped on the nameplate, as this identifies the motor and all its parts completely.

Do not remove the nameplate, as the information stamped on it is necessary in ordering repair parts.

(55) ELECTRIC LIGHTING, WESTINGHOUSE

Every car operator should attempt to become reasonably familiar with the units, connections and functions of the parts that make up the electrical equipment of his car. Such familiarity will be the best assurance against trouble and will make the location of trouble far less difficult. It is for this purpose that this instruction book is published.

Avoid unnecessary tinkering with the apparatus. As it is recognized that the average motorist is not an electrician, cases of trouble may arise that he cannot locate or repair. In such cases it is best to get in touch immediately with the car manufacturer, with his authorized dealer or with the nearest Westinghouse Service Station.

The Westinghouse electric lighting outfit consists of an electric generator, a lighting switch, an ammeter, fuse and coupling boxes and a battery.

The single wire (grounded return) system is used because of its simplicity and reliability. In this system the negative (—) terminal of the battery is connected to the electrical units and lamps through switches, and the positive (+) terminal of the battery is connected to the metal frame of the car, the frame of the car serving as one conductor. As the positive (+) terminal of each unit and all lamps except one head, and the dash, are connected to the metal frame of the car, either through mounting or by cable, the circuit is completed when the switch is closed.

In the following instructions and descriptions certain electrical terms are used and are explained herewith:

(a) Conductor.—A conductor is anything that readily carries electric current. In the Westinghouse system the conductors are copper wire, carbon brushes, tungsten filament of the lamps, car frame, etc.

(b) Ground.—When any wire or cable leading to the negative (—) battery terminal accidentally comes into metallic contact with any part of the car frame, to which the positive (+) terminal of the battery is connected, a "ground" results. In a single-wire system a "ground" is also a "short circuit."

(c) Grounded.—The positive (+) battery terminal and one terminal of all other units are electrically connected to the car frame and are said to be "grounded."

(d) Insulator.—Material that does not carry current readily is called an "insulator." In electrical equipment of automobiles, wood, micarta, rubber, cotton, etc., are "insulators."

(e) Insulated.—When one conductor is separated from another conductor by an insulator they are insulated from each other. In the single-wire system the conductors connected to the negative (—) terminal of the battery are insulated from the car frame.

(f) Live.—The parts connected to the negative (—), or insulated, battery terminal are referred to as “live.”

(g) Open Circuit.—If a conductor is broken, or if it becomes loose from its connection, the electrical circuit is open and no current can pass.

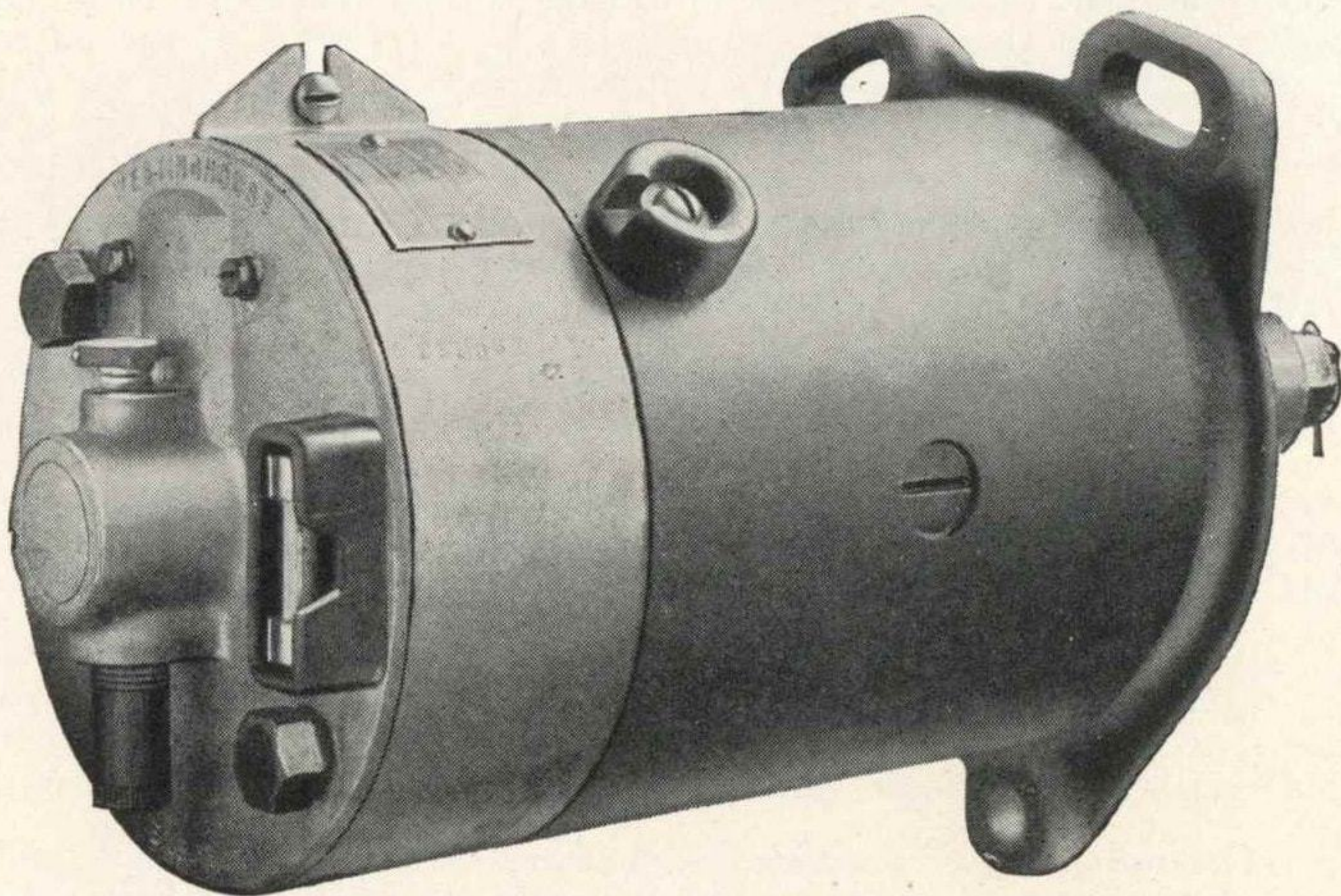
(h) Short Circuit.—A “short circuit” is a direct electrical connection between two points of opposite polarity—positive (+) and negative (—). For instance, the battery is short-circuited when a conductor touches both the positive (+) and negative (—) terminals, or if any point in the circuit leading directly to the one terminal of the battery is brought into metallic contact with a circuit leading directly to the other terminal.

A “short circuit” is extremely destructive to the electrical equipment, particularly to the battery, and should be carefully guarded against at all times.

56)

ELECTRIC GENERATOR

The generator which supplies electric current for the storage battery and the lights is driven from the engine. While the engine is not running or is running at very low speed, the lights are supplied entirely by the battery. At a predetermined speed the generator circuit is “cut in” on the battery circuit and the generator supplies some of the current used by the lights or begins charging the battery if the lights are not turned on.



The generator described is of the automatic type, the regulator being mounted integral with the generator at rear end.

(58) Cutout.—When the generator is being operated at a speed below the predetermined “cut-in speed,” the contacts of the cutout armature are open, the voltage of the generator being below that of the battery. When the generator speed reaches the “cut-in speed,” these contacts are closed, connecting the generator circuit to the battery circuit. The “cut-in speed” varies from five to ten miles per hour on high gear.

The “cut-in speed” of the generator can be observed by running the car, allowing it to increase in speed slowly and observing on the speedometer the speed at which the car is running when the cutout contacts close, which is indicated by a slight movement of the meter needle.

(59) Lighting Switch.—The connections of the various lights to the circuit are accomplished through the use of the lighting switch. Pulling out both buttons on the left side switch gives all lights bright. Pushing in first button to left gives all lights with heads dim. Pushing in both buttons, all lights off.

(60) Oiling.—The oil cup at each end of the generator should be given three or four drops of oil about twice every month, or every 500 miles of driving the car. This is very important. Use only the best quality of machine or engine oil.

(61) Brushes.—In general the wear on the brushes is so slight that they will outlast the car. They should not be disturbed except in case of trouble. These are removed by unscrewing the thumb-screw caps over them, when the brush and spring will come out together. In removing each brush it should be noticed which side was turned up and each brush should be replaced in its original holder with the proper side up, taking care to see that the brush is resting against the commutator. The adjustment of the spring should be such that there is at least $\frac{1}{2}$ -inch compression on it when the cap is screwed tight. In putting in new brushes care should be taken to see that they have a good bearing-fit over their entire surface on the commutator, grinding them in until this fit is obtained. To obtain satisfactory operation, always use brushes furnished by the manufacturer.

(62) Fuses.—Two or three sets of fuses of each size should be carried at all times. If a fuse is blown it should not be replaced until the cause is located. This may be due to a ground or short circuit in the wiring or socket of that circuit. Never use a piece of wire instead of a fuse.

(63) Capacity of Fuses.—The capacity of fuses in each circuit should be as follows: Head lights, 15 amperes; tail lights, 5 amperes.

(64) Precaution in Washing the Engine.—Before washing the engine with gasoline or kerosene, be sure to first disconnect the negative (—) battery terminal before beginning. Otherwise a spark may be produced between some “live” part and grounded part, which may ignite the gasoline. Reconnect the battery when danger of igniting fumes is past.

(65) Indication of Correct Solution.—When the battery is fully charged and gassing freely the specific gravity should be between 1.275 and 1.3. If materially higher, a little distilled water should be added; if materially lower,

add a very little chemically-pure sulphuric acid. The addition of acid should be done in the manner outlined in the battery instructions. In general, however, water only will be required.

(66) Regulation of Charge.—If the battery tends to run down, the car should be operated a larger portion of the time without lights or with fewer lights until the charge is increased. It should be borne in mind that when the engine is not running no charge is going into the battery. On the other hand, if the lights are on and the engine is idle, the battery is being discharged. In order to reduce the drain on the battery it is well to turn off as many of the lights as possible when the engine is idle.

(67) Indications of Discharged Battery.—If the specific gravity drops to 1.100 or 1.150, it indicates that the battery is discharged.

(68) LOCATION OF TROUBLES

When trouble arises it is desirable to locate it as quickly as possible. To assist in doing this we give below practically all the troubles that could occur with this system, and the possible causes of each, although very few of these troubles will ever be experienced. In locating the cause of the trouble, check up the various points in the order given, as the most likely cause and the one most easily tested is given first.

Lamps in One Circuit Do Not Burn.—This may be caused by—

(a) The lamp is burnt out. Try another lamp in the same socket.

(b) Blown fuse in that circuit. Try the same fuse in another circuit. If the fuse is blown do not replace it immediately, but look over the wiring for an accidental ground or short-circuit. In looking for grounds an abrasion of the insulation on the wire or a mechanical contact between the ends of cables or current carrying parts of the wiring devices and the metal of the car, socket, shells, etc., should especially be looked for. When the trouble has been located and corrected, replace the blown fuse with another of the same capacity. If the trouble cannot be located immediately, turn off the switch on the damaged circuit until the trouble has been located. If the trouble is in a particular lamp socket, disconnect the attachment plug from this socket until the trouble can be removed and see that the removed attachment plug does not touch the car frame in such a way as to make a short circuit.

(c) An open circuit, or broken or loose connection in the wiring. Examine the places where the connections are made on that particular circuit.

None of the Lamps Will Burn:

(a) Terminals of the battery are disconnected or corroded so that they do not make good contact.

(b) Ground wire from the battery to the chassis is disconnected or broken.

(a-1) Wire from battery terminal to the fuse box disconnected or broken.

(b-1) The lamps are burnt out.

(c-1) Battery is run down.

Lamps Go Out for An Instant Only.—If the lamps in one circuit act this way there is probably a loose connection on the circuit so affected. If all the lamps go out for an instant there is probably a loose connection at one end of the wire from the battery to the fuse box.

Lamps Become Dim When Engine Stops.—This indicates a discharged battery. If possible, have the battery charged at once from an outside source. If this cannot be done, endeavor to run with fewer lamps than normal turned on for a few days or until the battery voltage picks up again.

The Battery Does Not Stay Charged.—This may be due to any of the following:

(a) The car is not run enough without lights or at a high enough speed for the generator to charge the battery and replace the current that is taken from the battery when the lamps are burning with the engine idle or running at very low speed.

(b) A Ground in the Car Wiring.—With the engine idle and all switches "off," note if ammeter shows discharge. If so, there is a ground in the wiring between the battery, the generator and the switch or the magnetic switch if the regulator is not open.

(c) Regulator cutout switch is not operating properly.—Examine the switch and see that it is properly connecting and disconnecting the generator circuit. See diagram, page 42. The switch should be in the open position when the engine is not running or should stay in the closed position when the engine is running above "cut-in speed." If the switch does not close there may be oil on brushes or commutator or one of the brushes may be worn too short.

(69)

REPAIRS

Repairs and Responsibility Therefor.—In case any difficulty arises that cannot be readily located, notify the dealer from whom the car was purchased or an authorized representative for the make of car. The Westinghouse Electric and Manufacturing Company will not assume responsibility for repairs attempted by unauthorized parties or assume any guarantee obligation for the upkeep of any apparatus or parts supplied by the automobile owner or unauthorized parties. In case the dealer is unable to correct a difficulty which he assumes is due to fault in the Westinghouse equipment, he will request help from the Westinghouse Service Department.

In ordering repair parts always give all information on the name plate, as this identifies the generator and all its parts completely.

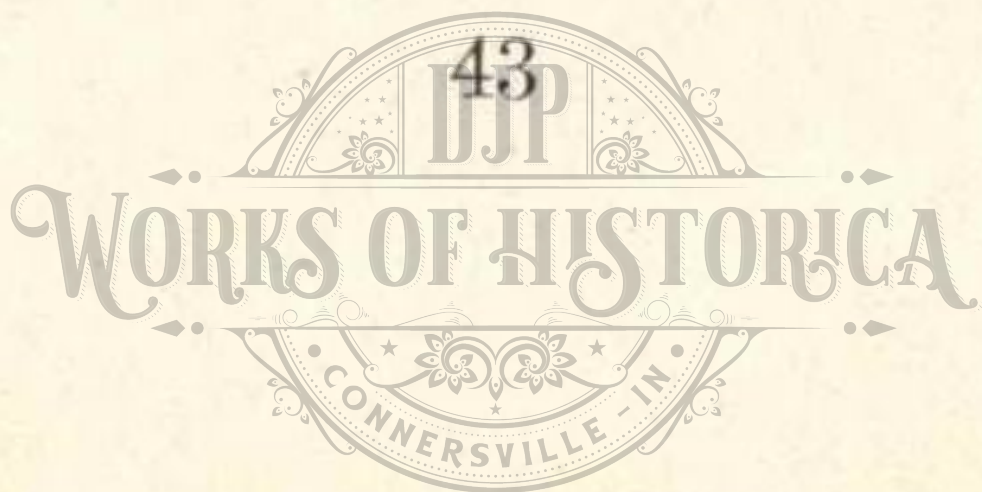
Do not remove the name plate, as the information stamped on it is necessary in ordering repair parts.

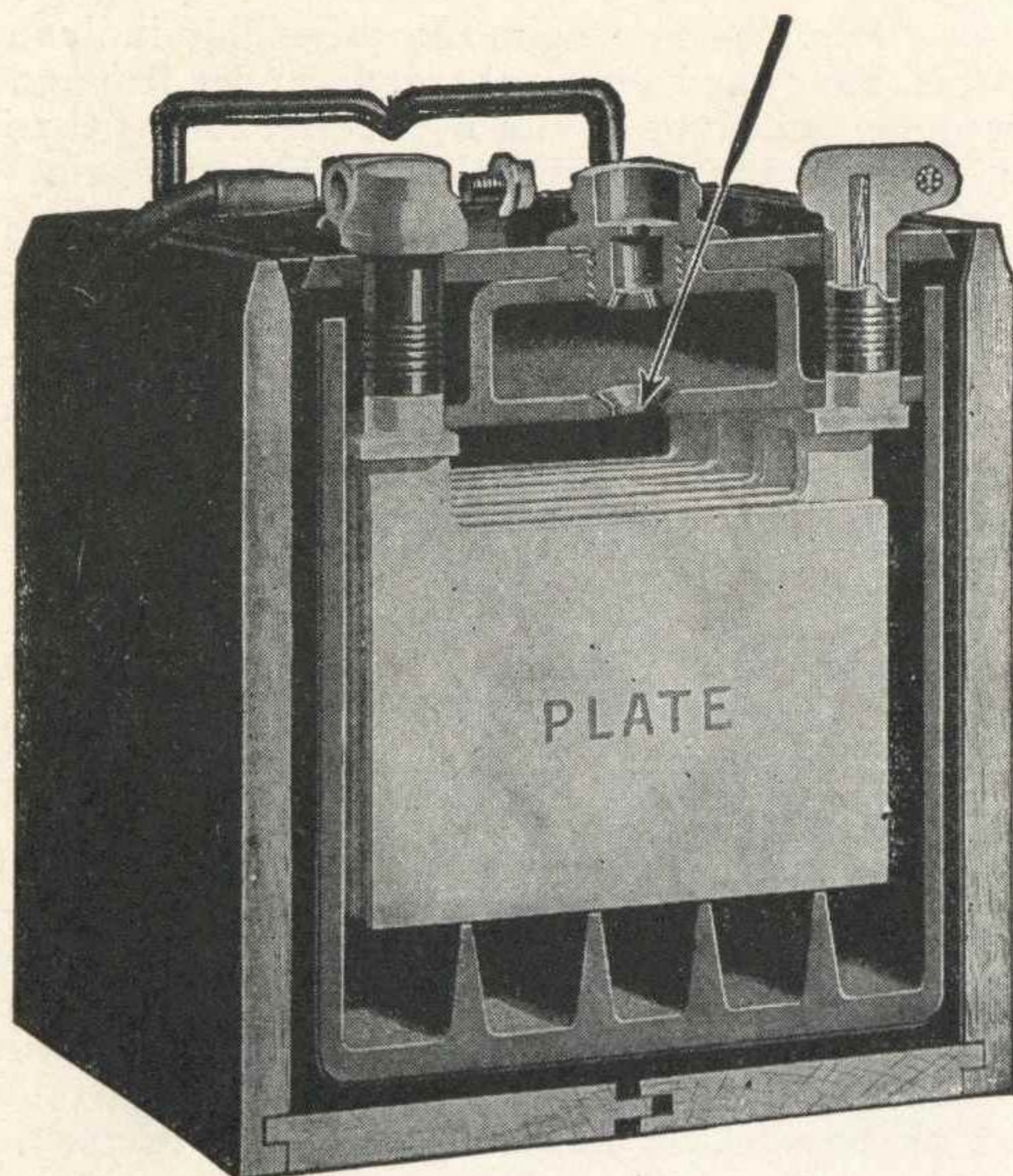
(70) Lamps.—For the best operation of this system, lamps of the highest quality should be used. Westinghouse Mazda automobile lamps have been especially designed for the service. We would recommend and advise their use in connection with this apparatus.

(71)

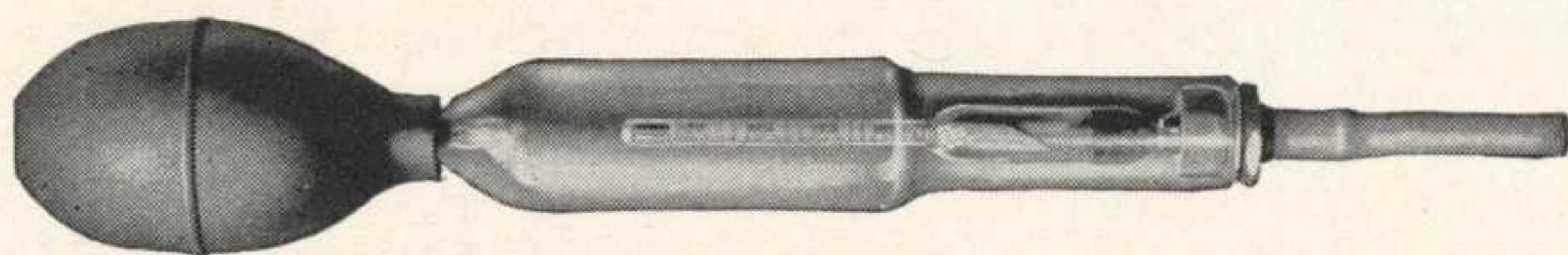
STORAGE BATTERY

The storage battery is made by the Willard Storage Battery Company and is known as the Threaded Rubber battery, No. SX-4, rated at 6 volts, 100 ampere hours. The storage battery is no doubt the most abused part of the car with most owners and yet it is one of the easiest parts to keep in good condition. Charging and discharging a storage battery is essentially a chemical action between the solution or electrolyte and the positive and negative lead plates.





A few points in regard to the care of the battery should be borne in mind. Keep the battery securely fastened in place. Pure water must be added regularly to all cells and at sufficiently frequent intervals to keep the solution level with the inside cover. Never allow the solution to get below the tops of the plates. Remove vent plug to pour in water and then screw on after filling. Use nothing but distilled water.



The best way to ascertain the condition of the battery is to test the specific gravity or density of the solution in each cell with a hydrometer at regular intervals. When all cells are in good order the gravity will test about the same in each. When fully charged, the readings will range from 1.275 to 1.300. Above 1.200 indicates that the battery is more than half charged. Below 1.200 and above 1.150 indicates battery is less than half charged. Gravity below 1.150 shows that the battery is completely discharged. If the battery should be found to be as low as 1.200 at any time, use the current sparingly until the gravity is restored to at least 1.250. Putting acid or electrolyte into the cells to bring up the specific gravity can do no good and may do great harm. A full charge is the only recourse to be had in bringing the battery back to normal condition. If for any reason an extra charge should be needed, it may be accomplished by running the engine idle. However, there should be no occasion for extra charging of this nature if the current is not unduly wasted.

A battery that is to stand idle for any length of time needs charging as much as one in active service. It may be kept in good condition by giving it a freshening charge by allowing the engine to run at least once a month. It should be given a thorough charge before it is put into active use again.

In order to avoid freezing of the battery, it should be kept in a fully charged condition. The electrolyte will freeze as follows:

Sp. gr. 1.120, battery discharged, 20 degrees above zero.

Sp. gr. 1.160, battery three-fourths discharged, zero.

Sp. gr. 1.201, battery one-half discharged, 20 degrees below zero.

Sp. gr. 1.260, battery one-fourth discharged, 60 degrees below zero.

Should the storage battery be removed at any time from the car, do not start motor, as you may ruin generator.

The Willard Storage Battery Company, of Cleveland, Ohio, maintains a large number of service stations for the benefit of the owner who has a Willard Storage Battery. As soon as you get your car, it would be well for you to get in touch with the nearest station.

(72)

WASHING THE CAR

No machine can remain in permanent adjustment with constant running when it has a coating of mud and sand dried and baked onto it. The tiny particles of grit work into the smallest joints about the moving parts and produce a cutting effect like so much emery. Great pains and much time have been spent in the painting and varnishing of the car. With a little care at the proper time there is no reason why this finish should not be as bright and full of life at the end of the year as it is when it leaves the factory.

Never allow anyone to rub his hands over the varnished surfaces. The dust particles will cause permanent scratches. A heavy coating of dust or even light splotches of mud should be washed off as soon as possible. Use water at a temperature around 70 degrees and a good-sized soft carriage sponge. Flow the water on so that the dirt will be soaked and loosened gradually. Never rub nor break it off. Do not allow the water to strike the finished parts with any force. If soap is necessary to remove greasy spots, use only the grades of linseed or castile soaps that are known to be neutral—free from excess alkali or acids. Do not use gasoline for this purpose. Rinse the car well and then rub dry with a chamois skin that is kept clean by frequently rinsing in water and wringing dry. The engine and all parts under the hood should be kept free from the accumulations of grease and dust by occasional applications of kerosene. An old scrub brush is wonderfully efficient for applying the kerosene and cleaning all the curved surfaces.

If a body polish is used, rub it lightly until it is thoroughly dry.

(73)

STORING THE CAR

It is far better to keep the car in service the entire year, but circumstances often demand that the car be stored for several months, especially through the winter.

When the car is to be stored, drain out the water from the radiator and pump pet cocks, also cylinder block. Be sure that it is all out. Give the car a thorough cleaning so that no dust or mud remains at any point. Jack up the wheels and remove the tires. Leave only enough air in the tubes to keep them stretched in shape. Wrap the tires in paper and keep in a dark, dry place. Paint the rims with a mixture of graphite and gasoline. Cover up the entire car with some sort of cover. A canvas or paper covering made especially for this purpose can be had at a slight cost.

(74)

CARBON DEPOSIT

Should too much oil be poured into the crank case or too rich a mixture of gasoline be used, there is the possibility of a coating of carbon collecting over the upper part of the inside of the cylinders and on the tops of the pistons. This carbon would collect exactly the same as it does on a lamp chimney when the flame is turned too high. Should the oil level be kept too high, the excess of oil would work up on the cylinders, past the rings of the pistons and into the space above the pistons where the explosions take place. Here the oil would partly burn and leave the soft carbon.

The heat resulting from the explosions would tend to harden the carbon and produce a hard scale. Too rich a gasoline mixture will cause a deposit of carbon in the cylinders as quickly as the use of too much oil, since the amount of gasoline can be mixed with air to form a mixture that will burn up entirely is limited.

When the carbon collects to any extent it may heat up and any tiny projection may become hot enough to set the incoming gas on fire, with the result that the explosion will come too soon. Such a condition will be indicated by a pounding noise and, generally, by overheating of the engine.

The engine will also begin to miss in certain cylinders on account of the carbon collecting on the spark plugs and forming a path for the current, which would prevent the occurrence of a spark. The scales of carbon will often become lodged under the exhaust valve and cause loss of compression. The engine will show a noticeable loss of power.

The best remedy for removing this carbon is, of course, the preventing of its formation by using the proper amount of cylinder oil and by using as thin a mixture of gasoline as possible at all times.

Once carbon is deposited in the cylinders, the best means of removing it is to remove the cylinder heads and scrape.

75)

VALVE GRINDING

The valves will require grinding from time to time. Loss of compression is the best indication that the valves require attention. The compression in each cylinder can be determined by using the crank and turning the crank shaft by hand. If there is considerable resistance offered in turning as the piston comes up on the compression stroke in each cylinder, with the priming cups open in the other five cylinders, the compression is all right, but if no difference is noted in turning through the four strokes, it is very probable that the valves need attention. Loss of power will be the first outward sign that should lead you to test the compression.

The valves should be ground at any time should carbon be removed. Remove the two cover plates on the righthand side of the engine just below the exhaust pipe. Disconnect the spark plug wires and take off the cylinder head. Use some sort of a bar, or a regular valve lifter, and press up on the spring on the side of the engine so that the little horseshow washer can be slipped off from the end of the valve stem. The valve springs may then be released and the valve pulled out from the top. It should not be necessary to remove the push rods in taking out the springs, but each adjusting screw should be correctly adjusted after the valves are ground in. See valve timing.

Wash off the valve in gasoline and place a small quantity of valve-grinding compound on the edge of the valve. There are any number of good valve

grinding compounds on the market that are suitable for such work. Replace the valve and rotate it back and forth by means of a brace and screw driver bit. Lift the valve up frequently so that grooves will not be cut in the valve seat. Do not push down on the brace too hard or continue turning the valve in one direction. It is better to rotate it in both directions, not giving more than one half turn at any time.

The valve is ground sufficiently when it has a bearing all around its face or seat. To determine when the grinding is complete, remove the valve and wash off the compound from both the valve and seat with gasoline. Apply a light coating of lamp black and oil to the valve seat. Replace the valve, turn it just about a quarter of a turn and lift out the valve. If the black is evenly distributed around the seat and valve face, the grinding is sufficient, but if spots appear, the grinding should be continued until the black will be evenly distributed.

Apply this treatment to each valve in turn until all twelve valves are ground. In most cases the exhaust valves will require more grinding than the intake valves, since carbon will lodge under them and the hot exhaust gases will cause pitting.

Thoroughly wash out each valve chamber with gasoline to remove every trace of the valve grinding compound.

(76) **REMOVAL OF PISTONS**

All six pistons may be removed from the bottom of the engine by taking off the oil reservoir. There is no need of having to take the cylinder head off. Disconnect the connecting rods from the crank shaft and turn the crank shaft until there is sufficient room to allow the piston to pass.

(77) **CONNECTING ROD AND CRANK SHAFT ADJUSTMENTS**

These may be adjusted by removing the oil pan from beneath the motor and taking out the proper amount of liners from beneath the caps. Care should always be taken to see that the connecting bearings are always kept properly adjusted.

If they are allowed to become loose, the engine will start pounding and ruin the bearing, or perhaps break a connecting rod or crank shaft.

(78) **RULES OF THE ROAD**

Before venturing upon the highway, an important thing for the novice is to acquaint himself with the various and universally observed rules of the road. Motorists are law-abiding as a class and none but the reckless will refuse or neglect to pay obedience to the rules established by law or custom for the guidance of all users of roads.

When meeting another vehicle coming from the opposite direction, it is the rule of the road in America for both vehicles to **KEEP TO THE RIGHT**, each turning to one side of the center of the road.

If the other vehicle be a horse-drawn vehicle, heavily laden or incapable of turning out for some reason or other, common courtesy will prompt the automobilist to permit that vehicle to keep the center of the road and pass it by going clear over to the right, even though this should involve traveling on the poorer portion of the highway.

In overtaking slower-going vehicles traveling in the same direction, it is the rule to **PASS TO THE LEFT**. Care should be taken, of course, not to occupy the right side of the road until completely clear of the vehicle just passed.

It is likewise a mere courtesy, and in some localities even a law, that one traveler shall not hold the road to the exclusion of other travelers, but shall **TURN TO HIS RIGHT WHENEVER POSSIBLE** to permit the vehicle following him to pass. It is a fact that more accidents are caused by vehicles crossing in front of others than in any other manner.

Excessive sounding of the horn is proof that the motorist is a novice. Sometimes, as in the presence of a frightened horse, it may be better not to use the horn at all.

No accepted rules exist in regard to the meaning of horn blasts, but it is reasonable to assume that prolonged honking indicates that the car behind is going to pass and desires a clear road.

Extending the arm to the right or left will caution the driver behind that you are going to turn in either direction.

Any indication that it may not be absolutely safe to go ahead should be occasion for an immediate stop. Likewise, if there should be any doubt in the operator's mind as to which way an approaching vehicle is going to turn, the car should be brought to a standstill.

There are laws in some states according to which an automobile has to come to a stop as soon as the driver of a horse-drawn vehicle holds up his hand. It is not wise to disregard this law, and since many timid drivers of horses derive some assurance from this rule, it may be considered a very good reason for the motorist to obey it.

(79)

SKIDDING

Skidding ordinarily occurs only on slippery surfaces and in rounding turns at high speed. In skidding, the wheels of the car slip on the ground, especially on wet asphalt or in mud, although the car will occasionally slide on dry surfaces, like sand or loose gravel.

When a straight course is maintained little skidding will be encountered. Where the traffic permits, the car should be run on the center of the road, because the road generally slopes toward the gutter. Curves should be rounded in as wide a circle as possible at the slowest speed.

A clever operator often may terminate a skid by turning his front wheels in the same direction in which the rear wheels skid. Sometimes a slight speeding up of the engine will neutralize skidding. However, skidding is one of the things which do not immediately concern the novice operator, who will acquire the necessary skill in avoiding skidding in actual practice.

(80)

CARE AND ADJUSTMENTS

Half of the ability to make an adjustment or repair is the ability to discover its necessity.

Never tinker with the different parts of the car, nor labor with the starting crank or have the electric starter turn the motor over many times without first bringing some little intelligent consideration to bear upon the question of what is most likely to cause the difficulty.

It is of little use to turn the engine over and over by the starting handle or by means of the engine starter in an effort to set it going. If the engine will not start with a few turns, the chances are that there is something radically out of order, requiring intelligent attention. With the carburetor giving a correct mixture, the ignition system affording a hot and effective spark and everything else apparently all right, it should be as easy to secure an explosion on the second stroke as on the sixtieth. So if the engine will not

start with the second or third attempt it is not likely to start with three or four hundred attempts, consequently it is better to find out the trouble than to turn the motor over indefinitely.

There are motorists who are said to have "luck" with their cars. There never seems to be any trouble with the car of such an owner; everything is trim and neat; the engine always starts when wanted and runs as long as it is needed without any of the exasperating break-downs on the road with which the unfortunate one thinks himself cursed through the carelessness of the manufacturer. With all adjustments carefully made, every bearing well oiled, the whole car works very sweetly and continues to run so with only a very small fraction of the attention that would be absolutely necessary for the care of a horse. To be sure, by neglecting details you will save a few moments in getting on your way, but the day of reckoning is sure to come. What you have saved in the garage will be spend on expensive roadside repairs. It is attention to the "little things" that counts.

(81) TO SECURE SATISFACTORY SERVICE FROM YOUR CAR

Keep out of crowded streets until you completely master the operation and driving of the car. Study carefully the method as outlined for starting the engine, starting the car, shifting the gears, and stopping the car. Never attempt to start the engine until it is made certain that the gear shift lever is in neutral.

Never start the engine on a wide open throttle or advanced spark.

Never allow the clutch to engage suddenly.

Never release clutch while driving without first closing throttle.

Never race the engine.

Never attempt to shift into reverse gear until the car comes to a complete standstill.

Never drive with a fully retarded spark.

Never drive fast on slippery streets.

Never drive fast around turns or over rough roads.

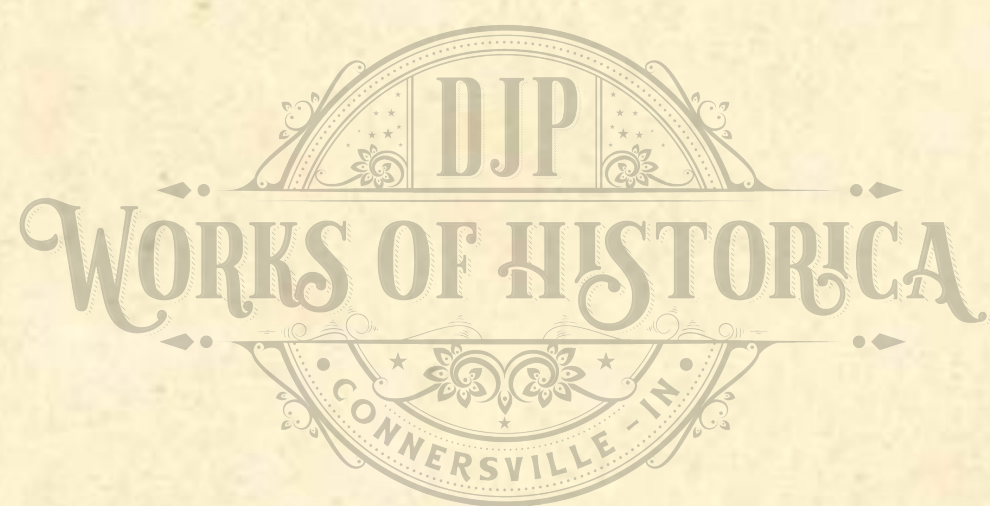
Never apply brakes suddenly except in case of emergency.

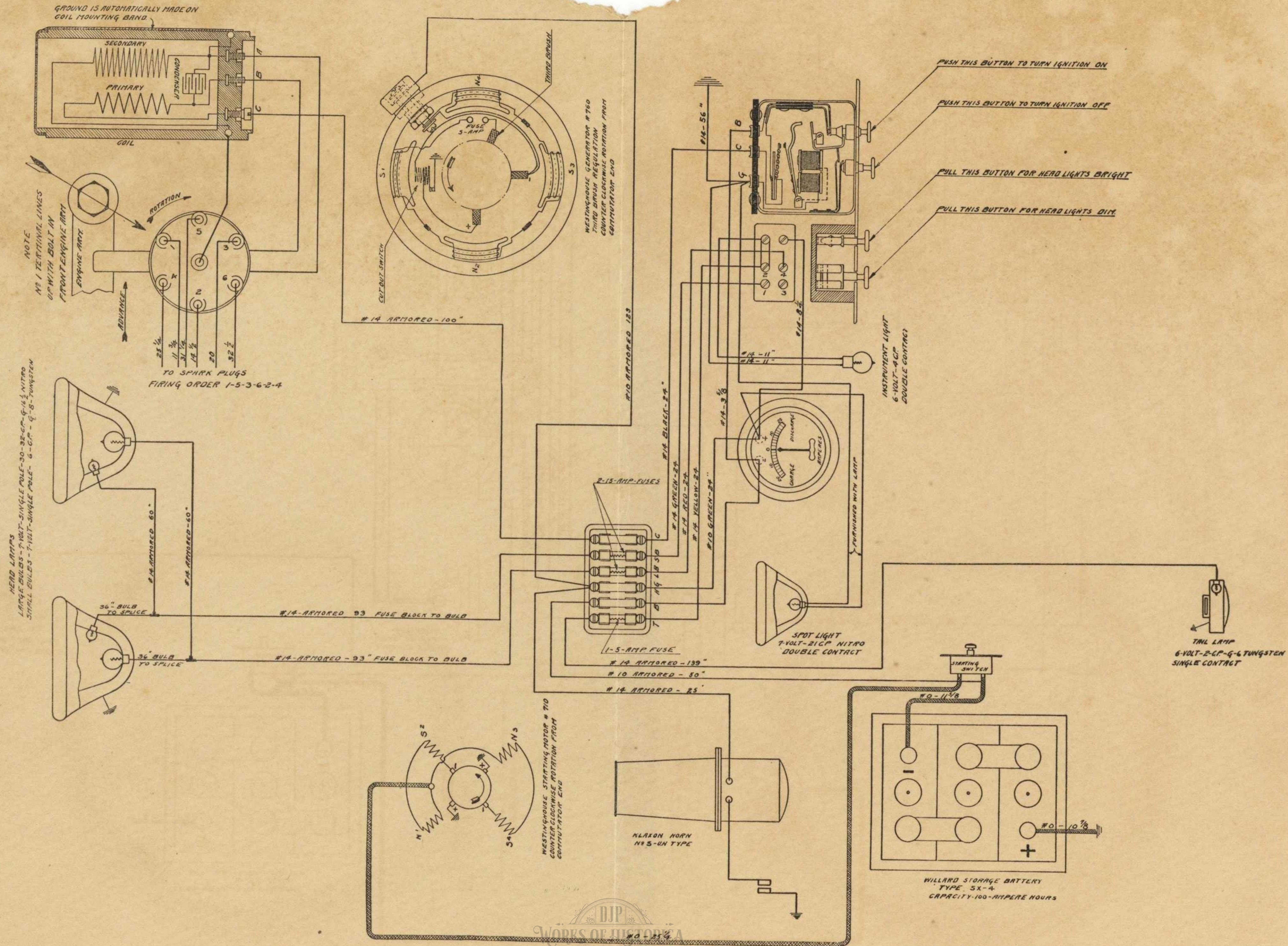
Above everything else, never neglect the lubrication of the car at any point.

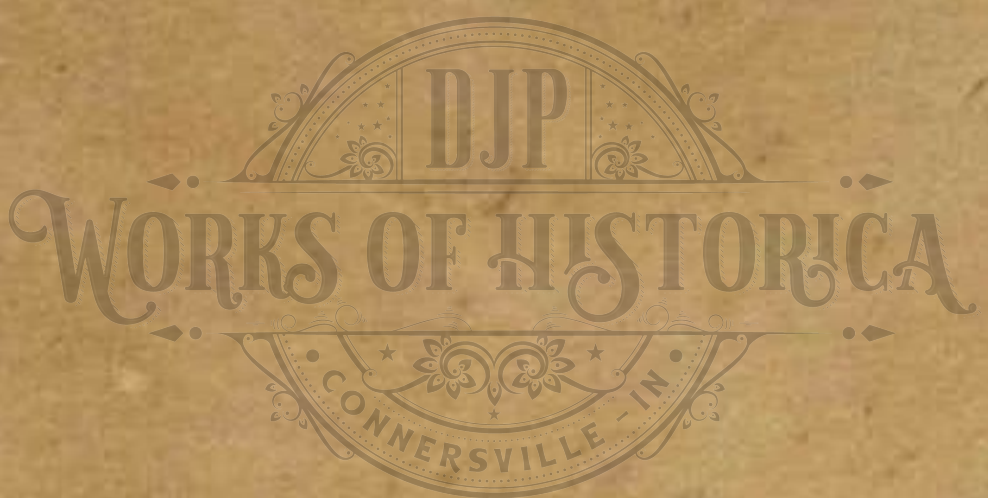
Study the car well so that you may understand the function of all parts but *do not tinker*.

Never attempt to make any adjustment unless you are absolutely certain that it is needed. More cars reach the repair shops through the overzealous attempts of the owner or driver to make an adjustment than ever come to the repair man through actual wear. If unusual sounds develop, investigate and find the cause. Do not allow them to continue, as much damage may result.

If the irregularity cannot be located, write to our TECHNICAL BUREAU and describe the symptoms in detail. Full explanation and information as to the remedy and adjustments will be sent you at once. Advice will be given cheerfully about any point in regard to cars. Always give the engine and car number when writing to us. It is to our interest as well as yours that you receive complete satisfaction from your car.







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